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BULLETIN

DE LA

SOCIÉTÉ FOUAD Ier D'ENTOMOLOGIE

FONDÉE LE 1er AOUT 1907

anciennement:

Société Entomologique d'Egypte (1907-1922)
et *Société Royale Entomologique d'Egypte* (1923-1937)

Placée sous le Haut Patronage du Gouvernement Egyptien
par Décret Royal en date du 15 Mai 1923

Année 1946

30

LE CAIRE
IMPRIMERIE PAUL BARBEY

1946

BULLETIN

DE LA

SOCIÉTÉ FOUAD Ier D'ENTOMOLOGIE

TRENTE-NEUVIÈME ANNÉE

TRENTIÈME VOLUME

1946

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1946

Les opinions émises dans les publications de la Société sont propres à leurs auteurs. La Société n'en assume aucunement la responsabilité.

Date de parution et de distribution du présent Volume :
31 Décembre 1946

Le Rédacteur en Chef :
A. ALFIERI

DÉCRET DONNANT LE DE NOM
FOUAD PREMIER
A DES INSTITUTIONS PUBLIQUES CRÉÉES SOUS SES AUSPICES [1]

Nous, FAROUK Ier, Roi d'Egypte,

Sur la proposition du Président de Notre Conseil des Ministres tendant à perpétuer le souvenir de feu le Roi Fouad Premier et à glorifier Son nom, vu que Son règne s'est distingué par des œuvres éminentes dans le domaine des réformes et par la création de maintes institutions publiques dont la réalisation s'est accomplie grâce à Ses conseils et à Sa sollicitude, ce qui a eu la plus grande influence sur l'orientation et le développement de la renaissance scientifique, littéraire, sociale et économique de l'Egypte;

Sur l'avis conforme de Notre Conseil des Ministres;

DECRETONS

Art. 1 — Le nom de Fouad Premier est donné aux institutions et établissements indiqués au tableau annexé au présent décret. [2]

Art. 2. — Le Président de Notre Conseil des Ministres est chargé de l'exécution du présent décret, qui entrera en vigueur dès sa publication au « Journal Officiel ».

Fait au Palais de Montazah, le 11 Gamad Tani 1357 (7 Août 1938).

FAROUK

Par le Roi :

Le président du Conseil des Ministres p.i.

ABDEL-FATTAH YEHIA

(*Traduction*)

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(1) Extrait du *Journal Officiel* du Gouvernement Egyptien, N° 94, du Jeudi 11 Août 1938.

(2) Parmi ces institutions et établissements, figure, sub 7 : *Société Fouad Ier d'Entomologie* **au lieu de** *Société Royale Entomologique d'Egypte.*

DÉCRET NOMMANT LE PRÉSIDENT DE LA SOCIÉTÉ FOUAD Ier D'ENTOMOLOGIE [1]

Nous, FAROUK Ier, Roi d'Egypte,

Vu le Décret du 15 Mai 1923 approuvant les Statuts de la Société Royale Entomologique d'Egypte (Société Fouad Ier d'Entomologie) ;

Sur la proposition du Président de Notre Conseil des Ministres et l'avis conforme du dit Conseil ;

DECRETONS

Art. 1. — Mahmoud Tewfik Hifnaoui Bey, Ministre de l'Agriculture, est nommé Président de la Société Fouad Ier d'Entomologie.

Art. 2. — Le Président de Notre Conseil des Ministres est chargé de l'exécution du présent décret.

Fait au Palais d'Abdine, le 6 Moharram 1359 (14 Février 1940).

FAROUK

Par le Roi :
Le Président du Conseil des Ministres,
ALY MAHER

(Traduction)

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(1) Extrait du *Journal Officiel* du Gouvernement Egyptien, 67ème année, N° 18, du Lundi 19 Février 1940.

HAUTS PROTECTEURS
DE LA SOCIÉTÉ FOUAD Ier D'ENTOMOLOGIE

Le Très Regretté Roi FOUAD Ier

et

Sa Majesté le Roi FAROUK Ier

MEMBRES BIENFAITEURS

1924

M. Moustapha Mourad El-Salanekli Bey, de Damanhour (Béhéra).

1925

S.E. El-Sayed Fathallah Mahmoud Pacha, de Rahmania (Béhéra); M. Riad Abdel-Kawi El-Gebali Bey, de Chebin-El-Kom (Menoufia); S.E. Georges Wissa Pacha, d'Assiout (Haute-Egypte); M. Yehia Kawalli Bey, de Minieh (Haute-Egypte); M. Yacoub Bibawi Attia Bey, de Minieh (Haute-Egypte); S.E. Hassan Charawi Pacha, de Minieh (Haute-Egypte); S.E. Habib Chenouda Pacha, d'Assiout (Haute-Egypte); M. Mohamed Tewfik Mohanna Bey, de Tewfikieh (Béhéra); M. Hassan Ahmed Moussa Bey, de Minieh (Haute-Egypte); M. Labib Barsoum Hanna Bey, de Minieh (Haute-Egypte); S.E. Hassan Mohamed El-Tahtawi Pacha, de Guirgheh (Haute-Egypte); M. Kassem Osman El-Labban Bey, de Guirgheh (Haute-Egypte); M. Dordeir El-Sayed Ahmed El-Ansari Bey, de Guirgheh (Haute-Egypte); M. Barsoum Said Abdel-Messih Bey, de Minieh (Haute-Egypte); M. Dordeir Taha Abou-Gounema Bey, de Minieh (Haute-Egypte).

1926

M. Mohamed Rifaat El-Roznamgy Bey.

1927

M. le Dr. Walter Innes Bey (décédé en 1937); M. le Dr. Avocat Giovanni Ferranti (décédé en 1946).

1928

M. le Professeur Hassan C. Efflatoun Bey, du Caire; M. Hugo Lindeman (décédé en 1937).

1932

M. Alfred Reinhart (décédé en 1935).

ORGANISATION ADMINISTRATIVE POUR L'ANNÉE 1946

Membres du Conseil

S.E. le Prof. Mahmoud Tewfik Hifnaoui Pacha, *Président.*

M. le Prof. Hassan C. Efflatoun Bey, *Vice-Président.*

M. Mohamed Soliman El-Zoheiry Bey, *Vice-Président.*

M. Anastase Alfieri, *Secrétaire-Général.*

M. Richard Wilkinson, *Trésorier.*

M. le Dr. Assaad Daoud Hanna.

M. le Dr. Mohamed Shafik Bey.

M. le Prof. Dr. Kamel Mansour.

M. Abdel-Meguid El-Mistikawy.

M. le Prof. Dr. Hamed Seleem Soliman Bey.

M. le Dr. Saadallah Mohamed Madwar.

M. Edgard Chakour.

Comité Scientifique

M. le Prof. Hassan C. Efflatoun Bey, M. le Prof. Dr. Kamel Mansour, M. le Dr. Assaad Daoud Hanna, M. le Prof. Dr. Hamed Seleem Soliman Bey, M. le Dr. Saadallah Mohamed Madwar, M. Mohamed Soliman El-Zoheiry Bey, M. Anastase Alfieri.

Censeurs

M. le Dr. A. Azadian et M. E. Kaourk.

LISTE DES MEMBRES

DE LA

SOCIÉTÉ FOUAD Ier D'ENTOMOLOGIE

EN 1946

(Les noms des Membres Fondateurs sont précédés de la lettre F)

Membres Honoraires

1908 ALLUAUD (Charles), Les Ouches à Crozant (Creuse), France.
1924 EBNER (Prof. Richard), 3, Beethovengasse, Vienne (X), Autriche.
1929 PEYERIMHOFF DE FONTENELLE (P. de), 87, Boulevard Saint-Saëns Alger, Algérie.
1908 PIC (Maurice), 3, Rue du Pont Neuf, Digoin (Saône-et-Loire), France.
1940 SILVESTRI (Prof. F.), Ecole Royale Supérieure d'Agriculture, Portici (Naples), Italie.
1929 THÉRY (André), 12, Rue Saint-Pierre, Neuilly (Seine), France.
1943 UVAROV (Dr. B.P.), British Museum (Natural History), Londres, S.W. 7, Angleterre.
F WILLCOCKS (F.C.), « Brambles », Hurst Lane, Sadlescombe (near (Battle), Sussex, Angleterre.

Membres Correspondants

1932 ALFKEN (J.D.), 18, Delmestrasse, Brême, Allemagne.
1926 HALL (Dr. W.J.), c/o The Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7, Angleterre.
1923 HERVÉ-BAZIN (Jacques), 44, Quai Béatrix, Laval (Mayenne), France.
1924 HINDLE (Prof. Dr. Edouard), Zoological Society of London, Regent's Park, London, N.W. 8, Angleterre.
1923 HUSTACHE (A.), Pensionnat Saint-Laurent, Lagny (Seine-et-Marne), France.
1925 KIRKPATRICK (Thomas Winfrid), East African Agricultural Research Station, Section of Entomology, Amani (via Tanga), Tanganyika Territory, British East Africa.

1934 Koch (C.), (13 b), Gelting (Post Pliening), Obb. Bayern, Amerikanische Zone, Allemagne.

1929 Masi (L.), Museo Civico di Storia Naturale « Giacomo Doria », 9, Via Brigata Liguria, Genova (102), Italie.

1928 Orchymont (A. d'), 132, Avenue Houba de Strooper, Bruxelles (II), Belgique.

1934 Paoli (Prof. Guido), Directeur du Reale Osservatorio per le Malatie delle Piante, 1, Via Marcello Durazzo, Genova, Italie.

» Schatzmayr (A.), Museo Civico di Storia Naturale, Corso Venezia, Milano, Italie.

1927 Williams (C.B.), Rothamsted Experimental Station, Harpenden, Herts, Angleterre.

Membres Titulaires

1913 Abaza Pacha (S.E. Fouad), Directeur Général de la Société Royale d'Agriculture, Boîte Postale N° 63, au Caire.

1943 Aboul-Nasr (Ahmed Emad El-Din), Démonstrateur au Département d'Entomologie, Faculté des Sciences, Université Fouad Ier, Abbassia, au Caire.

1908 Alfieri (Anastase), Secrétaire Général et Conservateur de la Société Fouad Ier d'Entomologie, Boîte Postale N° 430, au Caire.

1941 Amin El-Dib (Abdel-Latif), Faculté d'Agriculture, Université Farouk Ier, Damanhour, Basse-Egypte.

1943 Ammar (Mohamed Abdel-Guélil), Assistant Technique, Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1944 Atallah (Albert), Démonstrateur au Département d'Entomologie, Faculté des Sciences, Université Fouad Ier, 10, Sharia Masoud Baraka, Ard Raif, Choubrah, au Caire.

1938 Attia (Rizk), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1945 Azab (Dr. Ahmed Kamel), Département d'Entomologie, Faculté d'Agriculture, Université Fouad Ier, Sharia El-Madares, Ghizeh, près le Caire.

1938 Bailey Bros and Swinfen Ltd., 11, Ronalds Road, Highbury, London, N. 5, Angleterre.

1929 Bichara (Ibrahim), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1946 Bigio (Henri), Embassy Court, 11, Sharia Gabalaya, Ghézireh, au Caire.

1923 BODENHEIMER (Prof. F.S.), Hebrew University, Jerusalem, Palestine.

1944 BROWN (T.W.), Sharia Talaat, Ghizeh, près le Caire.

1938 CARNERI (Alexandre), Librairie Elpénor, 10, Sharia Chakour Pacha, Alexandrie.

1929 CASSAB (Antoine), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1943 CHAARAWI (Ahmed Mounir), Assistant Technique, Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

F CHAKOUR (Edgard), Secrétaire Général de la Société Anonyme des Eaux du Caire, Boîte Postale N° 55, au Caire.

1931 COMPAGNIE UNIVERSELLE DU CANAL MARITIME DE SUEZ (Monsieur l'Agent Supérieur de la), 20, Sharia Dar El-Chefa, Kasr El-Doubara, Boîte Postale N° 2120, au Caire.

1944 COYNE (Dr. F.P.), c/o Imperial Chemical Industries Ltd., Millbank, London, S.W. 1, Angleterre.

1934 CRÉDIT FONCIER EGYPTIEN (Monsieur l'Administrateur-Délégué), 35, Sharia El-Malika Farida, au Caire.

1944 DAIRA DRANEHT Pacha, Sarawella, par Kafr-Dawar, Basse-Egypte.

1938 DIRECTORATE-GENERAL OF AGRICULTURE, Ministry of Economics, Baghdad, Irak.

1928 DOLLFUS (Robert Ph.), Directeur de Laboratoire et de Recherches, Museum National d'Histoire Naturelle, 57, Rue Cuvier, Paris (Vme), France.

1919 EFFLATOUN Bey (Hassan C.), Professeur d'Entomologie et Vice-Doyen de la Faculté des Sciences, Université Fouad Ier, Abbassieh, au Caire.

1946 EL-KHISHEN (Shafik Aly), B.Sc., D.I.C., Ph. D., Faculté d'Agriculture, Université Farouk Ier, Damanhour, Basse-Egypte.

1944 FACULTÉ D'AGRICULTURE (Bibliothèque de la), Université Farouk Ier, Damanhour (Béhéra), Basse-Egypte.

1934 FACULTÉ D'AGRICULTURE, Université Fouad Ier, Sharia El-Madares, Ghizeh, près le Caire.

1946 FACULTÉ DE MÉDECINE (Bibliothèque de la), Université Farouk Ier, Alexandrie.

1941 FAHMY (Aly), Section d'Entomologie, Ministère de l'Agriculture. Dokki (Ghizeh), près le Caire.

1945 FEINSTEIN (Claude), 13, Sharia Djabarti, Alexandrie.

1914 GARBOUA (Maurice), 1, Midan Soliman Pacha, au Caire.

1907 GAROZZO (Arturo), Ingénieur Civil, 5, Sharia Champollion, au Caire.

1923 GEZIRA RESEARCH FARM (The Librarian), Department of Agriculture and Forests, Wad Medani, Soudan.

1938 GHABN (Dr. Abdel-Aziz), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1927 GHALI Pacha (S.E. Wacef Boutros), c/o S.E. Saba Habachi Pacha, 41, Sharia El-Malika Farida, au Caire.

1938 GHESQUIÈRE (J.), 87, Avenue du Castel, Bruxelles (W. St L.), Belgique.

1945 GREEN (J.) & Co., Département Agriculture, 147, Sharia Mohamed Bey Farid (ex Emad El-Dine), Boîte Postale N° 600, au Caire.

1921 GREISS (Elhamy), 215, Sharia El-Malika Nazli, au Caire.

1942 HABIB (Abdallah), Professeur d'Entomologie à l'Institut Supérieur d'Agriculture, Chebin El-Kom (Menoufieh), Basse-Egypte.

1936 HAFEZ (Mahmoud), Ph. D., Département d'Entomologie, Faculté des Sciences, Université Fouad Ier, Abbassieh, au Caire.

1944 HAFEZ (Moustafa), Laboratoire des Insectes Parasites, Cotton Research Board, Ghizeh (Orman), près le Caire.

1938 HAMZA (Soliman), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

» HANNA (Dr. Assaad Daoud), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1944 HASSAN (Dr. Abbas Ibrahim), Département de Zoologie, Faculté des Sciences, Université Fouad Ier (Ghizeh, Orman), 80, Sharia Saleh El-Din, Héliopolis, près le Caire.

1945 HASSAN (Dr. Ahmed Abdel-Gawad), Section d'Entomologie, Faculté d'Agriculture, Université Farouk Ier, Damanhour (Béhéra), Basse-Egypte.

1928 HASSAN (Dr. Ahmed Salem), Professeur de Zoologie et d'Entomologie à la Faculté d'Agriculture, Université Fouad Ier, Sharia El-Madares, Ghizeh, près le Caire.

1944 HASSAN (Mahrus Saleh), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1940 HIFNAOUI Pacha (S.E. le Prof. Mahmoud Tewfik), Conseiller Technique du Ministère de l'Agriculture et Président de la Société Fouad Ier d'Entomologie, Sharia Lazogly, Hélouan, près le Caire.

1927 HOUSNY (Mahmoud), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1943 HUSSEIN (Mohamed), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1938 IBRAHIM (Abdel-Hamid Ibrahim), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Guizeh), près le Caire.

1940 IBRAHIM (Ahmed Housny), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1944 IMPERIAL CHEMICAL INDUSTRIES (EGYPT), S.A., Boîte Postale N° 1184, Alexandrie.

1936 IMPERIAL CHEMICAL INDUSTRIES (EGYPT), S.A., 26, Sharia Chérif Pacha, P.O.Bag, au Caire.

1928 IZZET Bey (Mohamed), 14, Midan El-Daher, au Caire.

1927 KAMAL (Dr. Mohamed), Professeur d'Entomologie, Faculté des Sciences, Université Farouk Ier, Alexandrie.

1922 KAOURK (Elias A.), Avocat, c/o Egyptian Markets Company Ltd, 14, Sharia Emad El-Dine, au Caire.

1926 KASSEM (Mohamed), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1943 KEFL (Ahmed Hassanein El-), Démonstrateur au Département d'Entomologie, Faculté d'Agriculture, Université Fouad Ier, Sharia El-Madares, Ghizeh, près le Caire.

1938 KLEIN (Dr. H.Z.), Agricultural Research Station, Boîte Postale N° 15, Rehovoth, Palestine.

1923 LABORATOIRES D'HYGIÈNE PUBLIQUE (Bibliothèque), Sharia El-Sultan Hussein, au Caire.

1931 LAND BANK OF EGYPT (Monsieur l'Administrateur-Directeur), Boîte Postale N° 614, Alexandrie.

1944 LEAN (Owen Bevan), Chief Locust Officer, B.M.E.O., 10, Sharia Tolumbat, au Caire.

1934 LOTTE (Dr. F.), Médecin de la Compagnie Universelle du Canal Maritime de Suez, Boîte Postale N° 222, Port-Saïd.

1931 LYCÉES FRANÇAIS (Monsieur le Proviseur), 2-4, Sharia Youssef El-Guindi, au Caire.

1932 MADWAR (Dr. Saadallah Mohamed), Directeur de la Section Anti-Malaria, Ministère de l'Hygiène Publique, Sharia Meglis El-Nowab, au Caire.

1927 MANSOUR (Prof. Dr. Kamel), D. Sc., Département de Zoologie, Faculté des Sciences, Université Fouad Ier, Abbassieh, au Caire.

1943 MILAD (Dr. Anis Boutros), Entomologiste attaché à la Section de Pathologie Animale (Département Vétérinaire du Ministère de l'Agriculture), 1, Sharia Yacoub, El-Dawawine, au Caire.

1921 MISTIKAWY (Abdel Megid El-), Société Royale d'Agriculture, Boîte Postale N° 63, au Caire.

1945 MOAZZO (Polychronis Georges), 2, Sharia Young, Alexandrie.

1944 MORCOS (Georges), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1929 MOSSERI (Dr. Henri), 25, Sharia Talaat Harb Pacha, au Caire.

— MOUGEL (Henri), Professeur de Sciences Naturelles au Lycée Franco-Egyptien, Héliopolis, près le Caire.

1944 MOURSI (Dr. Abdel-Fattah Aly), Laboratoire des Insectes Parasites, Cotton Research Board, Ghizeh (Orman), près le Caire.

1943 NAKHLA (Naguib), Assistant Technique, Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1944 NASR EL-SAYED (Dr. Mahmoud), Microbiologiste aux Laboratoires Municipaux de Chimie et de Bactériologie, 8, Sharia Stanley Bay, Bulkeley, Ramleh.

1942 OKBI (Mahmoud Ismail El-), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1944 PALMONI (J.), Beth Gordon, Dagania A, P.O. Kinneret, Palestine.

1939 PANTOS (Jean G.), Ingénieur Agronome, c/o Société Fouad Ier d'Entomologie, Boîte Postale N° 430, au Caire.

1944 PLANTA & C° (J.), Boîte Postale N° 450, Alexandrie.

1928 PRIESNER (Prof. Dr. H.), au Caire.

1942 RAWHY (Soheil Hussein), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1932 RIVNAY (E.), Agricultural Research Station, Boîte Postale N° 15, Rehovoth, Palestine.

1943 RIZKALLAH (Ramses), Assistant Technique, Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1925 ROYAL ENTOMOLOGICAL SOCIETY OF LONDON (The), 41, Queen's Gate, South Kensington, Londres, S.W. 7, Angleterre.

1943 SAMAK (Mohamed Mohamed), Assistant Technique, Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1941 SAWAF (Saleh Kamel El-), Faculté d'Agriculture, Université Farouk Ier, Damanhour, Basse-Egypte.

1936 SAYED (Dr. Mohamed Taher El-), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1938 SHAFIK Bey (Dr. Mohamed), Directeur Technique de la Société Financière et Industrielle d'Egypte, Post Office Bag, Kafr-Zayat, Basse-Egypte.

1924 SHAW (Fred), Northgate, Sherborne, Dorset, Angleterre.

1943 SHEHATA (Ahmed Mohamed El-Tabey), Démonstrateur au Département d'Entomologie, Faculté d'Agriculture, Université Fouad Ier, Sharia El-Madares, Ghizeh, près le Caire.

1938 SOCIÉTÉ DU NAPHTE, S.A. (A.I. Mantacheff & Co.), 33, Sharia Chérif Pacha, au Caire.

1921 SOCIÉTÉ ROYALE D'AGRICULTURE, Laboratoire d'Entomologie de la Section Technique, Boîte Postale N° 63, au Caire.

1934 SOLIMAN Bey (Prof. Dr. Hamed Seleem), Doyen de la Faculté d'Agriculture, Université Fouad Ier, Sharia El-Madares, Ghizeh, près le Caire.

1928 SOLIMAN (Dr. Labib Boutros), Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

1946 TAHER (Mahmoud), c/o J. de Planta & Co., 1, Sharia Baehler, Kasr El-Nil, au Caire.

1926 TEWFIK (Mohamed), Conservateur des collections entomologiques de la Faculté des Sciences, Université Fouad Ier, Abbassieh, au Caire.

1935 TRACTOR AND ENGINEERING COMPANY, S.A.E. (The), 18, Sharia Emad El-Dine, Boîte Postale N° 366, au Caire.

1945 TRIANTAPHYLLIDIS (Nicolas P.), 12, Odos Admitou, Platia Attikis, Athènes, Grèce.

1946 WAHAB (Abdel-Megid Abdel-), M.Sc., Démonstrateur au Département de Zoologie, Faculté des Sciences, Université Fouad Ier (Abbassieh), 2, Sharia El-Kholafa, Choubrah, au Caire.

1926 WALY (Dr. Mohamed), Conférencier en Zoologie, Faculté des Sciences, Université Fouad Ier, Abbassieh, au Caire

1912 WILKINSON (Richard), Immeuble Baehler, 157, Sharia Fouad Ier, Zamalek, au Caire.

— WILTSHIRE (E.P.), Premier Secrétaire d'Embassade et Consul de S.M. Britannique, 19, Sharia Gameh Charkas, au Caire.

1946 ZAAZOU (Dr. Hussein), Faculté d'Agriculture, Université Farouk Ier, Damanhour, Basse-Egypte.

1943 ZAKI (Mikhaïl), Section d'Entomologie, Musée Agricole Fouad Ier, Dokki (Ghizeh), près le Caire.

1944 ZERVUDACHI (Emmanuel), Boîte Postale N° 1277, Alexandrie.

1938 ZOHEIRY Bey (Mohamed Soliman El-), Directeur de la Section d'Entomologie, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

Envois divers

Bibliothèque du Cabinet de Sa Majesté le Roi, Palais d'Abdine, au Caire.

Bibliothèque privée de Sa Majesté le Roi, Palais d'Abdine, au Caire.

Son Excellence le Grand Chambellan de Sa Majesté le Roi, Palais d'Abdine, au Caire.

Son Excellence le Président du Conseil des Ministres, au Caire.

Son Excellence le Ministre des Finances, au Caire.

Son Excellence le Ministre de l'Agriculture, Dokki (Ghizeh), près le Caire.

Son Excellence le Président de la Cour des Comptes, au Caire.

Son Excellence le Président du Conseil d'Administration de la Société Royale d'Agriculture, Boîte Postale N° 63, au Caire.

Monsieur l'Administrateur-Délégué du Crédit Foncier Egyptien, 35, Sharia El-Malika Farida, au Caire.

Son Excellence le Président du Conseil d'Administration de la Banque Misr, 151, Sharia Emad El-Dine, au Caire.

Monsieur le Directeur Général de l'Imperial Chemical Industries (Egypt), 26, Sharia Chérif Pacha, au Caire.

Monsieur le Directeur Général de la Société Financière et Industrielle d'Egypte, 2, Sharia Fouad Ier, Alexandrie.

Son Excellence le Sous-Secrétaire d'Etat, Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

Son Excellence le Secrétaire-Général du Ministère de l'Agriculture, Dokki (Ghizeh), près le Caire.

Bibliothèque Centrale de l'Université Farouk Ier, Palais Prince Omar Toussoun, Sharia Lumbroso, Moharrem Bey, Alexandrie.

Son Excellence l'Administrateur Général de la Khassa Royale, Palais d'Abdine au Caire.

Son Excellence le Directeur du Cabinet Européen de Sa Majesté le Roi, Palais d'Abdine, au Caire.

Bibliothèque du Ministère de l'Instruction Publique, Sharia El-Falaki, au Caire.

Bibliothèque Egyptienne, Midan Bab El-Khalq, au Caire.

Bibliothèque du Musée Agricole Fouad Ier, Dokki (Ghizeh), près le Caire.

Echanges

Afrique Occidentale Française

Institut Français d'Afrique Noire, Boîte Postale N° 206, Dakar.

Afrique du Sud

South African Museum, P.O. Box 61, Cape Town.

Department of Agriculture of the Union of South Africa (The Agricultural Journal of the Union of South Africa), Pretoria.

Department of Agriculture of the Union of South Africa, Division of Entomology, P.O. Box 513, Pretoria.

The Director, The Transvaal Museum, P.O. Box 413, Pretoria.

The Honorary Secretary, Entomological Society of Southern Africa, P.O. Box 103, Pretoria.

Algérie

Société d'Histoire Naturelle de l'Afrique du Nord, Faculté des Sciences d'Alger, Alger.

Office National Anti-Acridien, Institut Agricole d'Algérie, Maison-Carrée, Alger.

Allemagne

Deutsche Entomologische Gesellschaft, 43, Invalidenstrasse, Berlin (IV).

Senckenbergischen Bibliothek, Senckenberg-Anlage 27, Frankfurt A/M.

Bücherei des Zoologischen Museums, 43, Invalidenstrasse, Berlin N 4.

Gesellschaft für Vorratsschutz E.V. (Mitteilungen der), 31, Zimmermannstrasse, Berlin-Steglitz.

Bücherei der Biologischen Anstalt für Land- und Forstwirtschaft, 19, Königin-Luise-Str., Berlin-Dahlem.

Deustches Entomologisches Institut der Kaiser Wilhelm Gesellschaft (Arbeiten über morphologische und taxonomische Entomologie, Arbeiten über physiologische und angewandte Entomologie), 20, Gossler Strasse, Berlin-Dahlem.

Deutsche Kolonial und Uebersee-Museum, Bahnhofsplatz, Brême.

Naturhistorischer Verein der Rheinlande und Westfalens (Entomologische Blätter, Decheniana), 4, Maarflach, Bonn.

Münchner Entomologischen Gesellschaft E.V. (Mitteilungen der), c/o Dr. W. Forster, 51, Neuhauser Strasse (Zoolog. Staatssamlg.), Munich (2).

Angleterre

The Imperial Institute of Entomology, Publication Office (Review of Applied Entomology), 41, Queen's Gate, London, S.W. 7.

Zoological Museum (Novitates Zoologicæ), Tring Park, Tring, Herts.

The Apis Club (The Bee World), The Way's End, Foxton, Royston, Herts.

Cambridge Philosophical Society, New Museums, Free School Lane, Cambridge.

The Librarian, The Zoological Society of London, Zoological Gardens, Regent's Park, London, N.W. 8.

The Librarian, Department of Entomology, University Museum, Oxford.

Argentine

Instituto Biologico de la Sociedad Rural Argentina, Buenos Aires.

Sociedad Cientifica Argentina, 1145, Calle Santa Fé, Buenos Aires.

Sociedad Entomologica Argentina, 267, Calle Maipu, Buenos Aires.

Museo Argentino de Ciencias Naturales « Bernadino Rivadavia », Casilla de Correo N° 10, Suc. 5, Buenos Aires.

Ministerio de Agricultura (Boletin del Ministerio de Agricultura de la Nacion), Bibliotheca, 974, Paseo Colon, Buenos Aires.

Australie

The Australian Museum (The Librarian), Sydney, N.S.W.

Council for Scientific and Industrial Research, 314, Albert Street, East Melbourne, C.2.

The Entomologist's Office, Department of Agriculture, Sydney, N.S.W.

The Public Library, Museum, and Art Gallery of South Australia, Box 386 A, G.P.O., Adelaide, South Australia.

The Library of the Division of Economic Entomology, P.O. Box N° 109, Canberra City, F.C.T.

The Linnean Society of New South Wales, Science House, Gloucester and Essex Streets, Sydney, N.S.W.

Autriche

Administration-Kanzlei des Naturhistorischen Museums, Burgring 7, Vienne (I).

Zoologisch-Botanische Gesellschaft, 2, Mechelgasse, Vienne (III).

Koleopterologische Rundschau, c/o Zoologisch-Botanische Gesellschaft. 2, Mechelgasse, Vienne (III).

Belgique

Société Entomologique de Belgique, Musée Royal d'Histoire Naturelle de Belgique, 31, Rue Vautier, Bruxelles, 4.

Société Scientifique de Bruxelles, Secrétariat, 11, Rue des Récollets. Louvain.

Bulletin de l'Institut Agronomique et des Stations de Recherches de Gembloux, Institut Agronomique de l'Etat, Gembloux.

Lambillionea, Revue Mensuelle Belge d'Entomologie, c/o M. Lucien Berger, 2, Vallée des Artistes, Linkebeek, Bruxelles.

Annales du Musée du Congo Belge, Tervuren.

Association des Ingénieurs sortis de l'Institut Agronomique de l'Etat, à Gembloux, 35, Avenue des Volontaires, Anderghem-Bruxelles.

Brésil

Museu National, Quinta da Boa Vista, Rio de Janeiro.

Instituto Biologico, Bibliotheca, Caixa Postal 2821, São Paulo.

Instituto Oswaldo Cruz, Caixa de Correio 926, Rio de Janeiro.

Arquivos do Serviço Florestal, 1008, Jardim Botânico, Rio de Janeiro.

Academia Brasileira de Ciencias (Anais da Academia Brasileira de Ciencias), Caixa Postal 229, Rio de Janeiro.

Divisao de Intercambio e Documentacao, Praia de Botafogo, 186, Caixa Postal 4081, Rio de Janeiro.

Bulgarie

Institutions Royales d'Histoire Naturelle, Musée Royal d'Histoire Naturelle, Palais Royal, Sofia.

Société Entomologique de Bulgarie, Musée Royal d'Histoire Naturelle, Palais Royal, Sofia.

Société Bulgare des Sciences Naturelles, Musée Royal d'Histoire Naturelle, Palais Royal, Sofia.

Canada

Entomological Society of Ontario (The Canadian Entomologist & Reports), Guelph, Ontario.

Bibliothèque du Ministère Fédéral de l'Agriculture, Edifice de la Confédération, Ottawa.

Entomological Division, Department of Agriculture, Ottawa, Ont.
Estudios, Barcelona (II).

Nova Scotian Institute of Science, Halifax.

Chine

The Lingnan Science Journal, Lingnan University, Canton.

Bulletin of the Biological Department, Science College, National Sun Yat-Sen University, Canton.

Bureau of Entomology of the Chekiang Province, West Lake, Hangchow.

Chypre

The Cyprus Agricultural Journal (The Office of the Governement Entomologist), Nicosia.

Colombie (République de), Amérique du Sud

Facultad Nacional de Agronomia (Biblioteca de la), Medellin.

Cuba

Sociedad Cubana de Historia Natural « Felipe Poey » (Memorias), c/o Dr. Carlos Guillermo Agnayo, 25 N° 254, Vedado, La Havane.

Danemark

Entomologisk Forening, Zoologisk Museum, Krystalgade, Copenhague.

Egypte

Ministère de l'Agriculture, Bibliothèque de la Section d'Entomologie, Dokki (Ghizeh), près le Caire.

Société Royale d'Agriculture, Bibliothèque de la Section Technique, Boîte Postale N° 63, au Caire.

Union des Agriculteurs d'Egypte, 25, Sharia El-Cheikh Aboul-Sebaa, au Caire.

The Bee Kingdom, 60, Sharia Menascé, Alexandrie.

Al-Fellaha, Boîte Postale N° 2047, au Caire.

Société Royale de Géographie d'Egypte, 45, Sharia El-Cheikh Youssef, au Caire.

The Journal of the Royal Egyptian Medical Association, Kasr El-Aini Post Office, au Caire.

Société Fouad Ier d'Economie Politique, de Statistique et de Législation, Boîte Postale N° 732, au Caire.

Institut d'Egypte, 13, Sharia El-Sultan Hussein, au Caire.

Bibliothèque de la Faculté des Sciences, Université Fouad Ier, Abbassieh, au Caire.

Equateur (République de l'), Amérique du Sud

Director General de Agricultura (Revista del Departamento de Agricultura), Quito.

Boletin de la Seccion Agricola del Banco Hipotecario del Ecuador, Apartado 685, Quito.

Espagne

Instituto Nacional de 2a Ensenanza de Valencia, Laboratorio de Hidrobiologia Espanola, Valencia.

Junta para ampliacion de Estudios e Investigaciones Cientificas, 4, Duque de Medinaceli, Madrid.

Junta de Ciencies Naturales de Barcelona, Museo Municipal, Barcelona.

Eos, Revista Espanola de Entomologia, Instituto Espanol de Entomologia, Palacio del Hipodroma, Madrid (VI).

Real Academia de Ciencias y Artes de Barcelona, 9, Rambla de los Estudios, Barcelona (II).

Sociedad Espanola de Historia Natural, Museo Nacional de Ciencias Naturales, Hipodromo, Madrid (VI).

Estacion Central de Fitopatologia Agricola, 17, Miguel Angel, Madrid (6).

Etats-Unis

The Research Library, Buffalo Society of Natural Sciences, Buffalo Museum of Science, Humboldt Park, Buffalo, New-York.

University of Illinois Library, Exchange Division, Urbana, Illinois.

The Library, American Museum of Natural History, Central Park, West at 79th Street, New-York City.

California Academy of Science Library, Golden Gate Park, San Francisco, 18, California.

Academy of Natural Sciences, Entomological Section, Lagon Square, Philadelphia.

Experiment Station of the Hawaiian Sugar Planters' Association, P.O. Box 411, Honolulu, T.H., Hawaii.

Hawaiian Entomological Society (The Secretary), 1527, Keeaumoku Street, Honolulu 4, Hawaii.

Carnegie Museum, Department of the Carnegie Institute, Pittsburgh, Pennsylvania.

American Entomological Society (The), 1900, Race Street, Philadelphia. 3, Pa.

United States Department of Agriculture Library, Washington, D.C.

General Library, University of Michigan, Ann Arbor, Michigan.

United States National Museum, c/o Smithsonian Institution, Washington, D.C.

Smithsonian Institution Library, Washington, D.C.

New-York State College of Agriculture (The Library), Cornell University, Ithaca, New-York.

New-York Academy of Sciences, New-York.

Pennsylvania State Health Department, Pennsylvania.

University of California (The Library), College of Agriculture, Agricultural Experiment Station, Berkeley 4, California.

University of California, Citrus Experimental Station Library, Riverside, California.

Wisconsin Academy of Sciences, Arts, and Letters, Madison, Wisconsin.

The Library, Minnesota Agricultural Experiment Station, University Farm, Saint Paul, Minnesota.

Museum of Comparative Zoology, Harward College, Cambridge, Mass.

The Philippine Agriculturist (The Library of the College of Agriculture), Agricultural College, Laguna, Philippine Islands.

The Reading Public Museum and Art Gallery (The Librarian), Reading, PA.

Editorial Office, The American Midland Naturalist, University of Notre Dame, Notre Dame, Indiana.

Marine Biological Laboratory (The Library), Woods Hole, Mass.

The Library, State College of Washington, Agricultural Experiment Station, Pullman, Washington.

Finlande

Societas Entomologica Helsingforsiensis (Notulae Entomologicae), Museum Zoologicum, Helsingfors.

Societas pro Fauna et Flora Fennica, Kaserngatan 24, Helsinki.

Societas Zoologica-Botanica Fennica Vanamo, Säätytalo, Snellmaninkatu 9-11, Helsinki.

Société Entomologique de Finlande (Annales Entomologici Fennici), Institut de Zoologie Agricole et Forestière de l'Université, Snellmaninkatu 5, Helsinki.

France

L'Echange, Revue Linnéenne, 3, Rue du Pont Neuf, Digoin (Saône et Loire).

Revue française d'Entomologie, Museum National d'Histoire Naturelle (Entomologie), 45 bis, Rue de Buffon, Paris (V^e).

Revue Scientifique du Bourbonnais et du Centre de la France, 22, Avenue Meunier, Moulins (Allier).

Société d'Etudes des Sciences Naturelles de Nîmes, 6, Quai de la Fontaine, Nîmes (Gard).

Société de Pathologie Végétale et d'Entomologie Agricole de France, Laboratoire de Pathologie Végétale, Institut National Agronomique, 16, Rue Claude Bernard, Paris (V^e).

Société Linnéenne de Bordeaux, Athénée, 53, Rue Des Trois Conils, Bordeaux.

Société Linnéenne de Lyon, 33, Rue Bossuet, Lyon (VIe)

Société des Sciences Naturelles de l'Ouest de la France, Nantes (Loire Inférieure).

Association des Naturalistes de Levallois-Perret, 153, Rue du Président Wilson (Domaine de la Planchette), Levallois-Perret (Seine).

Société Linnéenne du Nord de la France, 81, Rue Lemerchier (M. Pauchet), Amiens.

Société Géologique de Normandie et des Amis du Museum du Havre, Hôtel des Sociétés Savantes, 56, Rue Anatole France, Le Havre (Seine Inférieure).

Société d'Histoire Naturelle de Toulouse (Monsieur P. Bonnet, Bibliothécaire de la), Faculté des Sciences, Toulouse.

Société Entomologique de France, Institut National Agronomique, 16, Rue Claude Bernard, Paris (V^e).

Société d'Etudes Scientifiques de l'Aude, Carcassone (Aude).

Annales des Epiphyties et de Phytogénétique, Centre National des Recherches agronomiques, à Versailles.

Museum National d'Histoire Naturelle, Bibliothèque, 8, Rue de Buffon, Paris (V^e).

Société de Zoologie Agricole (Revue de Zoologie Agricole et Appliquée), Faculté des Sciences, Institut de Zoologie, 40, Rue Lamartine, Talence (Gironde).

Grèce

Institut Phytopathologique Benaki, Kiphissia (près Athènes).

Bibliothèque de l'Institut et Musée Zoologique de l'Université, Athènes.

Hollande

Nederlandsche Entomologische Vereeniging (Bibliotheek van der), Zeeburgerdijk. 21, Amsterdam (O).

Landbouwhoogeschool, Laboratorium voor Entomologie, Berg 37, Wageningen.

Hongrie

Museum National Hongrois (Annales Historico-Naturales), 13, Barossutca, Budapest VIII.

Indes Anglaises

Zoological Survey of India (Records of the Indian Museum), Kaiser Castle, Benares Cautt.

Madras Governement Museum, Connemara Public Library, Egmore, Madras.

Office of the Director, Imperial Agricultural Research Institute, New Delhi.

Indes Néerlandaises

Den Directeur van's Lands Plantentium, Buitenzorg, Java.

Italie

Museo Civico di Storia Naturale « Giacomo Doria », 9, Via Brigata Liguria, Genova (102).

Rivista di Biologia Coloniale, 326, Viale Regina Margherita (Policlinico), Roma.

Museo Civico di Storia Naturale di Trieste (Atti del), 4, Piazza Hortis Trieste (10).

Società dei Naturalisti in Napoli, Reale Università, Via Mezzocannone, Napoli.

Società Entomologica Italiana, Museo Civico di Storia Naturale, 9, Via Brigata Liguria, Genova (102).

Società Adriatica di Scienze Naturali, 7, Via dell'Annunziata, Trieste.

La Stazione di Entomologia Agraria (Redia), 15, Via Romana, Firenze.

La Stazione Sperimentale di Gelsicoltura e Bachicoltura di Ascoli Piceno.

Istituto Zoologico dell'Università di Napoli (Biblioteca del), Via Mezzocannone, Napoli.

Laboratorio di Zoologia Generale e Agraria della Facolta Agraria, Portici (Napoli).

Laboratorio di Entomologia Agraria di Portici (Bolletino del), Portici (Napoli).

Institut International d'Agriculture (Bibliothèque de l'), Villa Umberto I, Rome.

Società italiana di Scienze Naturali, Palazzo del Museo Civico di Storia Naturale, Corso Venezia, Milano.

Istituto di Zoologia dell'Università di Genova (Bolletino dei Musei di Zoologia e di Anatomia comparata), 5, Via Balbi, Genova.

Società dei Naturalisti e Matematici di Modena, presso l'Università, Modena.

Istituto di Entomologia dell'Università, 6, Via Filippo Re, Bologna (125).

Accademia di Scienze, Lettere ed Arti in Padova, 15, Via Accademia, Padova (Veneto).

Museo di Storia Naturale della Venezia Tridentina (« Memoria del Museo di Storia Naturale della Venezia Tridentina » e « Studi Trentini di Scienze Naturali »), Casella Postale 95, Trento.

Istituto Agronomico per l'Africa Italiana (L'Agricoltura Coloniale), Ministero dell'Africa Italiana, 13, Via Fibonacci, Firenze.

Istituto di Entomologia Agraria e Bachicoltura dell'Università (Bolletino di Zoologia Agraria e Bachicoltura), 2, Via Celoria, Milano (133).

Società Veneziana di Storia Naturale (presso Sig. Antonio Giordani Soika), S. Marco 254, Venezia.

Japon

Saghalien Central Experiment Station, Konuma, Saghalien.

The Ohara Institute for Agricultural Research, Library, Kurashiki, Okayama-Ken.

Imperial Agricultural Experiment Station (Journal of the), Nishigahara, Tokyo.

Department of Agriculture, Government Research Institute, Taihoku, Formosa.

The Kansai Entomological Society, c/o N. Tosawa, Shibakawa-Noen, Kotoen, Mukogun, Hyogo-ken.

« Mushii », Entomological Laboratory, Department of Agriculture, Kyushu Imperial University, Fukuoka.

Takeuchi Entomological Laboratory (Tenthredo, Acta Entomologica), Shinomyia Yamashina, Kyoto.

Kenya Colony (British East Africa)

East Africa Natural History Society (The Hon. Secretary), Coryndon Memorial Museum, P.O. Box 658, Nairobi.

Libye

Museo Libico di Storia Naturale, Piazza Santa Maria degli Angeli Tripoli d'Africa.

Maroc

Société des Sciences Naturelles du Maroc, Institut Scientifique Chérifien, Avenue Biarnay, Rabat.

Bureau de la Défense des Végétaux, 65 bis, Avenue de Témara, Rabat.

Mexique

Junta Nacional Directora de la Campana contra la Langosta (Junosta), Biblioteca, Departamento Directivo, Veracruz.

Biblioteca del Instituto Biotecnico, Calzada Mexico-Tacuba N° 295, Col. Anahuac, D.F.

Biblioteca del Instituto de Biologia, Chapultepec (Casa del Lago), Mexico, D.F.

Anales de la Escuela Nacional de Ciencias Biologicas, Apartado Postal 7016, Mexico, D.F.

Norvège

Tromso Museum Library, Tromso.

Panama (République de)

Departamento Seccional de Agricultura (Boletin Agricola), Panama.

Pologne

Musée Zoologique Polonais, ul. Wilcza N° 64, Varsovie.

Société Polonaise des Entomologistes, Rutowskiego 18, Lwow.

Institut de Recherches des Forêts de l'Etat, Wawelska 54, Varsovie.

Portugal

Société Portugaise des Sciences Naturelles, Faculté des Sciences, Rue de l'Ecole Polytechnique, Lisbonne.

Museum Zoologique de l'Université de Coimbra, Largo Marquês de Pombal, Coimbra.

Associaçao da Filosofia Natural (Bibliotecario da), Faculdade de Ciencias, Porto.

Roumanie

Société Transylvanienne des Sciences Naturelles (Siebenbürgischer Verein für Naturwissenschaften), Hermannstadt, Sibiu.

Academia Romana, Bibliothèque, Calea Victoriei, 125, Bucarest.

Russie (U.S.S.R.)

Société Entomologique de Russie (Revue Russe d'Entomologie et Horae), Musée Zoologique de l'Académie des Sciences, Léningrad.

Bibliothèque de l'Académie des Sciences de l'Ukraine, 58a, Rue Korolenko, Kiew (Ukraine).

Société des Naturalistes de Kiew, 37-10, Rue Korolenko, Kiew (Ukraine).

Institut des Sciences Naturelles, Université M. Gorky, 1 ul. Genkelya, Zaimka, Molotov (Ourals).

Institute for Plant Protection, Bureau of Applied Entomology and Zoology, Library, 10, Elagin Ostrov, Léningrad.

Rédaction du Journal « Plant Protection », 7, Rue Tschaikovsky, Léningrad.

Institute for controlling Pests and Diseases, Library, 7, Rue Tschaikovsky, Léningrad 28.

Siam

Department of Agriculture and Fisheries, Entomology Section, Bangkok.

Suède

K. Swenska Vetenskapsakademien i Stockholm (Bibliotek), Stockholm 50.

Entomologiska Föreningen (Bibliothèque de l'), Stockholm, 50.

Göteborgs Kungl. Vetenskaps-och Vitterhets Samhälles, Göteborg.

Statens Växtskyddsanstalt, Stockholm 19.

Bibliothèque de l'Université de Lund, Lund.

Suisse

Bibliothèque de la Société Entomologique Suisse, Musée d'Histoire Naturelle, Berne.

Zentralbibliotek (Tauschabteilung), Naturforschenden Gesellschaft, Zurich.

Tchécoslovaquie

Societas Entomologica (Casopis), u Karlova 3, Prague II.

« Sbornik » (Acta Entomologica), Section de Zoologie du Musée National, Prague, II-1700.

Bibliothèque de la Société Zoologique Tchécoslovaque, Institut de Zoologie, Karlov 3, Prague II.

Uruguay (République de l')

Escuela de Veterinaria del Uruguay (Anales de la Escuela de Veterinaria del Uruguay), Itazaingo 1461, Montévideo.

Sociedad de Biologia de Montevideo, Casilla de Correo 567, Montevideo.

Yougoslavie

Societas Entomologica Jugoslavica (Glasnik), 17, Garasaninovo ulica, Belgrade.

PROCÈS-VERBAUX DES RÉUNIONS

Réunion Amicale du 28 Janvier 1946

Le dix-huitième anniversaire de l'inauguration du Siège de la Société par le très regretté Roi Fouad I a été commémoré au cours de cette réunion annuelle.

Séance du Conseil du 27 Février 1946

Présidence de Monsieur le Professeur H. C. EFFLATOUN Bey,
Vice-Président

Subvention :

La Société a reçu L.Eg. 1000, subventon 1945 du MINISTÈRE DE L'AGRICULTURE. Le Conseil remercie.

Donations :

Le CRÉDIT FONCIER EGYPTIEN et la BANQUE MISR ont fait parvenir L.Eg.50 et L.Eg. 25 respectivement. Le Conseil remercie.

Dons à la Bibliothèque :

Monsieur le Professeur SILVESTRI, de Portici (Naples, Italie), adresse six tirés à part de ses travaux entomologiques publiés durant les années 1941-1945. Le Conseil remercie.

Admission de Membres :

Messieurs HENRI BIGIO et ABDEL MAGID ABDEL WAHAD sont admis à faire partie de la Société en qualité de Membres Titulaires, présentés par Messieurs le Professeur Docteur KAMEL MANSOUR et A. ALFIERI.

Rapport Annuel :

Le Conseil approuve la teneur des Rapports du Secrétaire Général, du Trésorier et des Censeurs pour l'Assemblée Générale Ordinaire qui est fixée pour le 27 Mars 1946.

Distinctions Honorifiques :

Sa Majesté le Roi, dans Sa Haute sollicitude, a daigné conférer le grade de Pacha à Son Excellence le Professeur MAHMOUD TEWFIK HIFNAOUI, le grade de Bey à Messieurs le Professeur Docteur HAMED SELEEM SOLIMAN et MOHAMED SOLIMAN EL-ZOHEIRY, la quatrième classe (Officier) de l'Ordre d'Ismaïl à Monsieur ANASTASE ALFIERI, la cinquième classe (Chevalier) de l'Ordre du Nil à Monsieur le Docteur ABDEL-AZIZ GHABN. Le Conseil adresse ses plus sincères félicitations à ces distingués collègues.

Assemblée Générale Ordinaire du 27 Mars 1946

Présidence

de Monsieur le Prof. Dr. Hamed Seleem Soliman Bey.

Rapport du Secrétaire Général (Exercice 1945) :

Messieurs,

Aux termes des Articles 24, 25 et 26 de nos Statuts, vous avez été convoqués en Assemblée Générale Ordinaire pour prendre connaissance des Rapports du Secrétaire Général, du Trésorier et des Censeurs sur la situation morale, financière et comptable de la Société, donner au Conseil décharge de sa gestion, et procéder, par voie d'élections, au remplacement des Membres sortants du Conseil, ainsi que des deux Censeurs chargés de la vérification des comptes de l'Exercice en cours.

Voici maintenant, dans les grandes lignes, un aperçu des principales manifestations de notre activité sociale, administrative et scientifique durant l'Exercice.

Nous avons reçu de Sa Majesté le Roi Farouk Ier une nouvelle preuve de Sa sollicitude éclairée à notre égard. Sa Majesté nous a fait don de quatre boîtes de coléoptères égyptiens et exotiques, dont un bon nombre d'espèces constitue une précieuse acquisition pour nos collections. Nous sommes heureux d'adresser ici, au Souverain, l'hommage de notre profonde et respectueuse reconnaissance.

La perte de notre Vice-Président Honoraire, Maître Giovanni Ferrante, membre fondateur de la Société, nous a profondément affectés. Ce distingué collègue a beaucoup contribué au développement de notre Institution. Il nous a fait don, en 1928, de toutes ses collections entomologiques. Il a droit à notre souvenir reconnaissant. En évoquant sa mémoire nous rendons hommage aux qualités de cœur et d'intelligence qui le caractérisaient.

Les travaux de la Commission pour la lutte anti-acridienne dans le Moyen-Orient se sont déroulés au Siège de notre Société.

Nous nous sommes réjouis de voir nos collègues le Professeur Docteur Hamed Seleem Soliman Bey et le Docteur Mohamed Kamal promus doyens, respectivement, de la Faculté d'Agriculture Fouad Ier et de la Faculté d'Agriculture Farouk Ier.

Citons avec gratitude les donations qui nous ont été faites par la Société Royale d'Agriculture, le Crédit Foncier Egyptien, la Banque Misr, l'Imperial Chemical Industries, le Ministère des Wakfs et la Société Financière et Industrielle d'Egypte, respectivement de 50, 50, 25, 25, 20 et 15 livres égyptiennes.

Monsieur le Professeur Hassan Chaker Efflatoun Bey a publié la première partie de sa Monographie des Bombyliides d'Egypte. Cette étude magistrale, consignée dans le vingt-neuvième volume de notre Bulletin, comprend 406 pages de texte et 552 figures formant 38 planches. On y trouve les descriptions des 108 espèces capturées en Egypte, dont 28 nouvelles pour la Science et un genre nouveau.

Des conférences publiques ont été données par Messieurs Mahmoud Taher, le Docteur A. A. Moursi, le Docteur M. H. Zazou, M. A. Ezzat, M. Bashir, A. Issa, le Docteur Mohamed Kamal, et Moustafa Hafez.

Comme par le passé, un grand nombre de spécialistes du Ministère de l'Agriculture, de professeurs et d'étudiants des Facultés des Sciences et d'Agriculture Fouad Ier et Farouk Ier ont bénéficié des diverses possibilités offertes par la Société : renseignements entomologiques, références bibliographiques, et très nombreuses déterminations d'insectes.

Notre Bibliothèque, de plus en plus fréquentée, possède actuellement 14784 ouvrages et brochures, soit une augmentation de 480 unités. Voici la liste des principaux ouvrages acquis : Journal of the New-York Entomological Society (volumes 1-16, 1893-1908), Annals of the Entomological Society of America (volumes 1-34, 1908-1941), Proceedings of the Entomological Society of Washington (volumes 1-42, 1884-1940), Bulletin of Entomological Research (volumes 1-35, 1910-1944), Genera Insectorum (7 fascicules), M.E. Candèze (Monographie des Elatérides, 5 volumes, 1857-1874). En outre, nous avons pu relier 287 volumes.

Votre Trésorier a établi le Bilan des Comptes du trente-huitième Exercice Social, dûment vérifié et approuvé par vos Censeurs, ainsi que les Prévisions Budgétaires pour l'Exercice 1946. Notre déficit est de L.Eg. 1228 et 414 millièmes, résultant du non payement, avant la date de clôture de nos Comptes, de la subvention de L.Eg. 1000 du Ministère de l'Agriculture, et du fait des achats d'ouvrages et des reliures effectués pour la Bibliothèque. En conséquence, votre Conseil a décidé de procéder aux plus strictes économies durant l'année en cours. Notre Bulletin se limitera à environ 250 pages. Il ne sera fait aucun achat d'ouvrages pour la Bibliothèque, pas de reliures. Cependant, malgré cette compression des dépenses, nous aurons encore un déficit de L.Eg. 107 qu'il nous faudra prélever du capital social. Nous solliciterons la bienveillante intervention de Son Excellence le Ministre de l'Agriculture afin que la subvention annuelle qui nous est accordée par

son Ministère soit portée à L.Eg. 1500, ce qui nous permettrait de retablir notre équilibre budgétaire.

Aux termes de l'Article 13 de nos Statuts, le Conseil est annuellement renouvelé par tiers. Les membres sortants cette année sont les suivants : Messieurs le Docteur Assaad Daoud Hanna, Richard Wilkinson, Abdel-Mégid El-Mistikawy, et Edgard Chakour. Ils sont rééligibles.

Vos Censeurs, Messieurs le Docteur A. Azadian et E. A. Kaourk, sont également rééligibles.

Nous terminons ce Rapport en dédiant nos respectueuses pensées à Sa Majesté le Roi Farouk Ier, et Lui exprimons nos sentiments de profond dévouement et nos vœux les plus fervents.

Signé : A. Alfieri.

Rapport du Trésorier :

Comptes Profits et Pertes au 31 Décembre 1945

DÉPENSES	L.E.	MM.	RECETTES	L.E.	MM.
Loyer	1	005	Subvention Ministère Agriculture	—	—
Impôts et Assurances	62	815	Donations	184	845
Frais Généraux et Entretien	237	088	Cotisations des Membres	114	845
Personnel	1042	800	Droits d'Inscriptions	1	800
Publications	637	090	Intérêts de Banque	24	338
Bibliothèque	247	594	Coupons Emprunt National	583	520
			Vente Publications et divers	90	630
			Déficit 1945 prélevé sur Capital	1228	414
	2228	392		2228	392

Bilan au 31 Décembre 1945

ACTIF	L.E.	MM.	PASSIF	L.E.	MM.
Immeuble Social	1	000	Réserve Générale	14906	396
Mobilier	1	000			
Bibliothèque	1	000			
Collections	1	000			
Laboratoire	1	000			
Banque Nationale d'Egypte	1709	137			
Portefeuille Emprunt National	13187	630			
Compagnie du Gaz	4	629			
	14906	396		14906	396

Portefeuille Titres en dépôt à la Banque Nationale d'Egypte : 18000 L.Eg. Emprunt National 3 ¼ % (1963-1973).

Signé : R. Wilkinson

Rapport des Censeurs :

En exécution du mandat que vous avez bien voulu nous confier, nous avons l'honneur de porter à votre connaissance que nous avons vérifié les Comptes de la Société Fouad Ier d'Entomologie pour l'année finissant le 31 Décembre 1945, avec les régistres et documents y relatifs.

Nous certifions que le Bilan reflète d'une façon exacte et sincère la situation de la Société telle qu'elle ressort des régistres et des explications qui nous ont été données.

Signé : Dr. A. Azadian et E. Kaourk

Prévisions Budgétaires pour l'année 1946 :

RECETTES	L.E.	MM.	DÉPENSES	L.E.	MM.
Subvention Ministère Agriculture	1000	000	Loyer	1	000
Donations	185	000	Impôts	36	000
Cotisations des Membres	100	000	Assurances	27	000
Coupons Emprunt National	583	000	Frais Généraux	250	000
Intérêts de Banque	20	000	Entretien	50	000
Vente Publications	5	000	Personnel	1043	000
Prélèvement sur capital	107	000	Publications	550	000
			Abonnements Bibliothèque	5	000
			Imprévus	38	000
	2000	000		2000	000

Signé : R. Wilkinson

Séance du Conseil du 17 Avril 1946

Présidence de Monsieur Mohamed Soliman El-Zoheiry Bey, *Vice-Président*

Donations :

La Société a reçu L.Eg. 50 de la Société Royale d'Agriculture et L.Eg. 25 de l'Imperial Chemical Industries. Le Conseil remercie.

Nécrologie :

Le Secrétaire Général a le regret de faire connaître le décès du Major STANLEY SMITH FLOWER. Le défunt faisait partie de notre Société depuis 1919. Il en fut son Président en 1921 et Membre Honoraire à partir de 1924.

Middle East Traffic Conference :

Les travaux de ce Congrès se sont déroulés dans notre Siège.

Bureau du Conseil pour l'Exercice 1946 :

Sont réélus : Messieurs le Professeur H.C. EFFLATOUN Bey et MOHAMED SOLIMAN EL-ZOHEIRY Bey, *Vice-Présidents ;* Monsieur ANASTASE ALFIERI, *Secrétaire Général ;* Monsieur RICHARD WILKINSON, *Trésorier.*

Comité Scientifique :

Sont réélus : Messieurs le Professeur H.C. EFFLATOUN Bey, MOHAMED SOLIMAN EL-ZOHEIRY Bey, le Professeur Docteur KAMEL MANSOUR, le Professeur Docteur HAMED SELEEM SOLIMAN Bey, le Docteur ASSAAD DAOUD HANNA, le Docteur SAADALLAH MOHAMED MADWAR, et ANASTASE ALFIERI.

Commémoration du Dixième Anniversaire de la mort du Roi Fouad Ier

Les Membres du Conseil se sont rendus à la mosquée d'El-Rifaï dans la matinée du 28 Avril 1946. Ils ont déposé une couronne de fleurs naturelles dans le mausolée royal et se sont respectueusement inclinés devant Sa Majesté le Roi Farouk Ier. A l'issue de cette cérémonie, ils s'en furent inscrire leurs noms sur les régistres du Palais d'Abdine. Dans l'après-midi, ils ont assisté à la commémoration organisée par l'Université Egyptienne Fouad Ier et durant laquelle le Président de la Société prononça une allocution de circonstance.

A cette occasion Monsieur ANASTASE ALFIERI, Secrétaire Général de la Société, évoque quelques souvenirs qu'il a conservés du très regretté Roi Fouad Ier et que l'on lira ci-dessous :

En dépit des événements qui ont bouleversé la structure sociale du monde, les Institutions Scientifiques créées ou patronnées par le Roi Savant, feu Fouad Ier, poursuivent inlassablement le but élevé pour lequel elles ont été fondées. C'est que le Grand Roi les avait non seulement dotées des moyens d'existence indispensables, mais leur a aussi légué un caractère de continuité.

Ils ne sont plus de ce monde tous ceux qui eurent l'honneur de présider, sous l'égide du Monarque défunt, aux destinées de la Société Fouad Ier d'Entomologie. Ils auraient aimé retracer eux-mêmes, en ce moment, l'œuvre de rénovation culturelle accomplie au cours du grand règne de Fouad Ier.

Mais l'Histoire se charge de transmettre aux générations la pensée royale. Actes, paroles, encouragements du Grand Animateur de la Science ont été pieusement recueillis par tous et particulièrement par ceux qui furent comblés des bienfaits de l'Auguste Souverain.

Le 29 Avril 1923, Fouad Ier daignait recevoir au Palais d'Abdine les Membres du Conseil de la Société Fouad Ier d'Entomologie. Imaginez leur émotion lorsqu'ils entendirent ces paroles royales :

« J'ai suivi vos débuts difficiles. Je suis au courant des écueils que vous avez rencontrés sur votre chemin. Vous n'en avez que plus de mérite. L'entomologie est une science intimement liée à l'Agriculture. Insectes nuisibles, insectes utiles, c'est à vous à les recenser, à étudier les méthodes les plus appropriées pour combattre les uns, pour multiplier les autres. Vous aurez également à établir de combien et de quelles espèces est composée la faune entomologique de l'Egypte. Je vous en donnerai tous les moyens. Il vous faut un local, une bibliothèque, des laboratoires, etc. ; vous les aurez ».

Le miracle ne tarda pas à s'accomplir. Les dons affluèrent, le Siège de la Société était construit, les laboratoires équipés, la bibliothèque garnie.

Fouad Ier avait une prédilection et un véritable amour pour les livres. Un jour, au cours d'une audience royale accordée à un de nos membres, Sa Majesté dit : « Sans doute les ouvrages de base doivent avoir la préférence ; mais n'oubliez pas que les petites brochures de quatre pages, ou même moins, sont parfois d'un intérêt considérable pour l'investigateur. Ne les négligez pas ».

Disons, en passant, que cet amour que Fouad Ier avait des livres suscita une heureuse émulation qui fit dire au propriétaire d'une des principales librairies de la capitale, à un client de marque tel que Sa Majesté le Roi Ferdinand Ier de Bulgarie : « le public suit l'impulsion de son Souverain, il achète tout ce qu'il peut, c'est à qui possèdera la bibliothèque la mieux fournie ».

Puis vint le jour où Fouad Ier, qui suivait de près les travaux et le développement continuel de la Société, estima que son local était désormais trop étroit pour le grand rôle qu'il était destiné à remplir.

« Oui, vous ambitionniez un tout petit local, celui que Je vous ai construit dépassait vos espérances ; mais vous voilà déjà à l'étroit. Ce n'est pas cette génération qui récoltera les fruits de vos efforts, mais celles qui suivront. Elles doivent trouver prêts tout ce que Je leur prépare. Nous semons, elles récolteront ». Ainsi parla Fouad Ier ; et une aile supplémentaire vint s'adjoindre au local primitif.

Fouad Ier avait désigné le Siège de la Société Fouad Ier d'Entomologie pour abriter les travaux des délégués qui devaient prendre part à la IVe Con-

férence Internationale de Recherches Anti-Acridiennes. La cérémonie inaugurale eut lieu le 14 Avril 1936, au Théâtre Royal de l'Opéra, en présence de Son Excellence le Président du Conseil, délégué de Sa Majesté le Roi. Malgré Son état de santé, Fouad Ier tint à avoir le compte-rendu complet de cette solennité. Il s'éteignait six jours après la clôture des travaux de la Conférence. Comme pour rendre hommage aux vertus du Roi Savant, les lois inexorables de la nature avaient attendu, pour Le ravir à l'amour des Siens et à l'affection de Son peuple, la conclusion heureuse de cette dernière manifestation scientifique de Son Règne.

Ce matin, dans le mausolée d'El-Rifaï, nous avons déposé des fleurs et nous nous sommes pieusement recueillis ; mais il existe un autre mausolée où se conservent aussi intacts le culte et la mémoire du Grand Animateur et Protecteur de la Science, et c'est le Siège de la Société Fouad Ier d'Entomologie et le cœur de ses Membres reconnaissants pour tous Ses bienfaits.

Anniversaire de l'Avènement au Trône de Sa Majesté le Roi Farouk Ier

Le 6 Mai 1946 les Membres du Conseil ont assisté à la réception royale du Palais d'Abdine et se sont inscrits sur les régistres du Palais.

Conférence du 8 Mai 1946

Monsieur Mohamed Soliman El-Zoheiry Bey : Les insecticides nouveaux.

Thé d'Honneur

Les Membres de la Société ont tenu à honorer tous ceux de leurs collègues qui ont récemment bénéficié de grades et décorations. Ils furent conviés à un Thé d'Honneur servi au Siège de la Société, le 16 Mai 1946, et auquel étaient également invitées d'éminentes personnalités. Plusieurs discours ont été prononcés.

Séance du Conseil du 20 Novembre 1946

Présidence de S.E. Mahmoud Tewfik Hifnaoui Pacha.

Nécrologie :

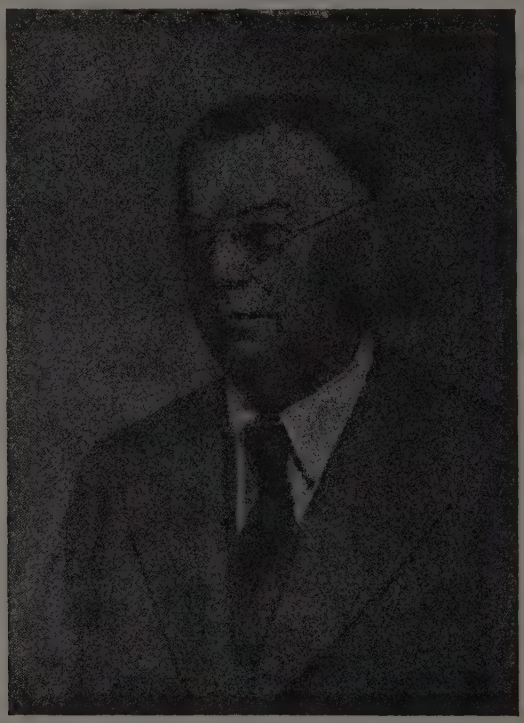
Le Secrétaire Général a le profond regret d'annoncer le décès de neuf de ses Membres. Voici l'appel des noms :

Docteur A. Azadian, du Caire, membre titulaire dès 1924 et Censeur de nos Comptes depuis 1926. Décédé en Septembre 1946.

Docteur Auguste Cros, de Mascara (Algérie), membre correspondant depuis 1924, spécialisé dans l'étude des formes primaires des Méloides.

Robert du Buysson, de Saint-Rémy-la-Varenne (France), membre honoraire depuis 1908, spécialiste en Hyménoptères, a surtout étudié les Chrysides dont il a publié une Révision des espèces égyptiennes dans le premier fascicule de nos Mémoires.

Henri Gadeau de Kerville, de Rouen (France), membre correspondant depuis 1934.



Dr. Ange-Marie Honoré

Docteur Ange-Marie Honoré, chimiste en chef de la Société Générale des Sucreries et de la Raffinerie d'Egypte, membre titulaire depuis 1924, spécialiste en Hyménoptères, a publié plusieurs études remarquables sur les Sphégides d'Egypte. Décédé en Juin 1946.

Docteur Paul Marchal, d'Antony (France), membre honoraire dès 1909.

L'abbé G. Parent, de Pas-de-Calais (France), membre honoraire depuis 1929, spécialiste en Diptères.

ALEXANDRE PETROFF, d'Alexandrie, ancien Consul de Russie, membre titulaire depuis 1911, a réuni d'importantes collections de Lépidoptères et de Coléoptères d'Egypte. Décédé en Juillet 1946.

Docteur JOSEPH VILLENEUVE, de Rambouillet (France), membre honoraire depuis 1920, spécialiste en Diptères.

Aux familles des défunts, aux Institutions scientifiques auxquelles ils appartenaient, nous exprimons nos condoléances et toute notre sympathie.

Donations :

La Société a reçu L.Eg. 15 de la SOCIÉTÉ FINANCIÈRE ET INDUSTRIELLE D'EGYPTE et L.Eg. 20 du MINISTÈRE DES WAKFS. Le Conseil remercie.

Dons à la Bibliothèque :

Monsieur A. D'ORCHYMONT, de Bruxelles (Belgique), a fait don des tirés à part de 19 de ses travaux sur les Hydrophilides, publiés de 1936 à 1943.

Monsieur E.P. WILTSHIRE, premier Secrétaire d'Embassade et Consul britannique au Caire, nous a remis les tirés à part de ses travaux sur les Lépidoptères, à savoir : 15 études publiées dans l' « Entomologist's Record », années 1937-1946 ; 3 études publiées dans « The Entomologist », années 1936-1945 ; 1 étude constituant le Bulletin No. 30 du Directorat-Général de l'Agriculture de Baghdad (Irak), 1944 ; et 3 études publiées dans le « Journal of the Bombay Natural History Society », volumes XLII (1941) à XLIV (1943).

Le Conseil remercie.

Admission de Membres :

Sont admis à faire partie de la Société en qualité de Membres Titulaires, Messieurs MAHMOUD TAHER, de la Maison J. Planta & Co., et le Docteur SHAFIK ALY EL-KISHEN, de la Faculté d'Agriculture de Damanhour (Université Farouk Ier), présentés par Messieurs MOHAMED SOLIMAN EL-ZOHEIRY Bey et le Docteur ASSAAD DAOUD HANNA ; Monsieur E. P. WILTSHIRE, premier Secrétaire d'Embassade et Consul de Sa Majesté britannique au Caire, et Monsieur HENRI MOUGEL, Professeur au Lycée Franco-Egyptien d'Héliopolis, présentés par Messieurs RICHARD WILKINSON et A. ALFIERI.

Distinctions Honorifiques :

Sa Majesté le Roi, dans Sa Haute sollicitude, a daigné conférer la quatrième classe (Officier) de l'Ordre d'Ismaïl à Monsieur RICHARD WILKINSON, Trésorier de la Société, et la cinquième classe (Chevalier) de l'Ordre du Nil à Monsieur. MOHAMED HUSSEIN. Le Conseil adresse ses plus vives félicitations à ces distingués collègues.

Nomination d'un Censeur :

A la suite du décès de notre très regretté collègue feu le Docteur A. AZADIAN, Censeur des Comptes de la Société, le Conseil a pourvu à son remplacement en confiant ces fonctions à Monsieur ELHAMY GREISS, du département de Botanie de la Faculté des Sciences (Université Fouad Ier)

Conférence du 4 Décembre 1946

Monsieur ABDEL-LATIF ISSA : Les Borers du maïs.

The symbiosis of *Eucampsipoda ægyptia* Mcq.

[Diptera Pupipara : Nycteribiidae]

(with 5 Figures)

by M. Aschner,
Department of Hygiene and Bacteriology,
The Hebrew University, Jerusalem.

The existence of a symbiotic relationship between blood-sucking pupiparous Diptera and bacteria was first recognized by Roubaud (1919). Further details concerning the symbiosis and especially the anatomical changes associated with the symbionts in the larva and imago have been described by Zacharias (1928) and Aschner (1931). The descriptions of these authors cover 12 species belonging to 7 different genera. Although the symbionts and the anatomical changes connected with them vary from genus to genus, certain characteristic features are common to all the species so far examined. On the basis of these constant characteristics a general scheme of the symbiotic relationship in pupipara can be sketched.

Symbionts are found in the Hippoboscidae always closely connected with the digestive tract, usually in certain epithelial cells of the gut. The constant presence of these micro-organisms in the gut has led to different hypothesis which ascribe to the micro-organisms a specific role in the nutrition of the host (Buchner, 1930). The simultaneous presence of the same micro-organism in the so-called milk glands was interpreted as a means for the transmission of the symbiont to the offspring. In the closely related Nycteribiidae, wingless parasites living exclusively on bats, symbionts are not directly connected with the gut but enclosed in special cell groups situated in the dorsal part of the posterior abdomen. The transmission to the offspring is effected in the same way as in the Hippoboscidae through infected milk glands. The location of the symbionts in any species of the Hippoboscidae or the Nycteribiidae is identical in both the sexes. In the male, however, the number of the symbionts is usually smaller correspondingly to the dimensions of the intestine and no equivalent for the infection of the milk glands exists.

The symbiosis in *Eucampsipoda aegyptia* does not conform in certain points with the above scheme. As these deviations seem to throw light on the question of the role of symbionts in a blood-sucking insect, they will be described here in some detail.

The material examined was collected in a cave near Herzelia (about 15 kms. north of Tel-Aviv) from *Rousettus aegypticus* E. Geoffr. For histological examinations the insects were fixed with Bouin and the paraffin sections were stained with Giemsa or Heidenhain. The symbionts them-

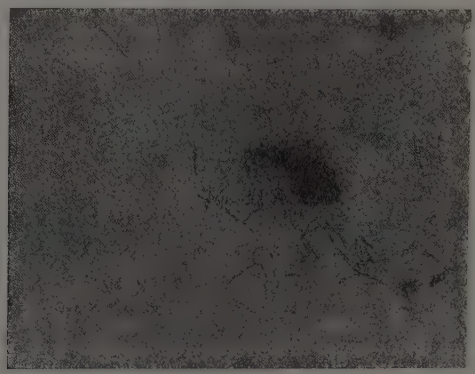


Fig. 1. — The thread-like symbionts in a smear from the milk gland. Giemsa stain. — × 600.

selves were studied in Giemsa stained smears of the milk glands, where they appear as rather uniform thread-like bacteria of considerable length (Fig. 1). The histological examination reveals at once a significant difference in the localization of the symbionts between *Eucampsipoda aegyptia* and the other hitherto described Nycteribiidae. In *Eucampsipoda aegyptia* all the symbionts are concentrated in the lumen of the milk glands. There is no special organ or group of cells outside these glands to harbour the micro-organisms. The milk glands themselves undergo a special modification which enables them to hold the enormous amount of symbionts which in other Nycteribiidae is present in the special bacterial organ, the mycetome. The lumen of the milk gland is widened greatly at the closed ends of the tubuli so that a capacious wide cavity is formed at each end which is nearly filled out by the dense mass of the symbionts. The single symbionts are arranged close to each other and parallel to the longer axis of the lumen (Fig. 2). In sections cut at a right angle through such a cluster of micro-organisms it is seen that the center is less closely packed than the periphery. Thus the flow of the gland secretion in the lumen is not impaired (Fig. 3). The symbiont-harbouring cavities are not lined as are the other parts of the lumen with the charac-

teristic corrugated structure of the intima but with a smooth thin membrane. Symbionts are carried in considerable amounts together with the gland secretion to the larva and it is easy to find them in large numbers mixed

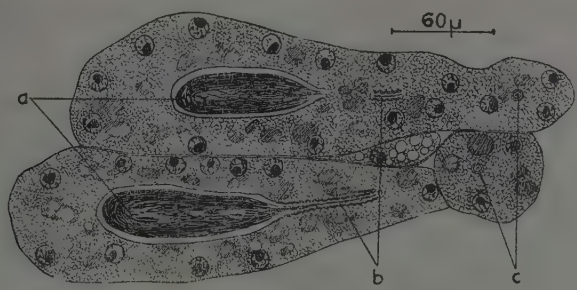


Fig. 2. — Section through milk gland tubuli showing the large end cavity filled with the dence mass of symbionts at *a*, and the regular glandular duct in longitudinal and transversal sections at *b* and *c* respectively. Heidenhain stain.

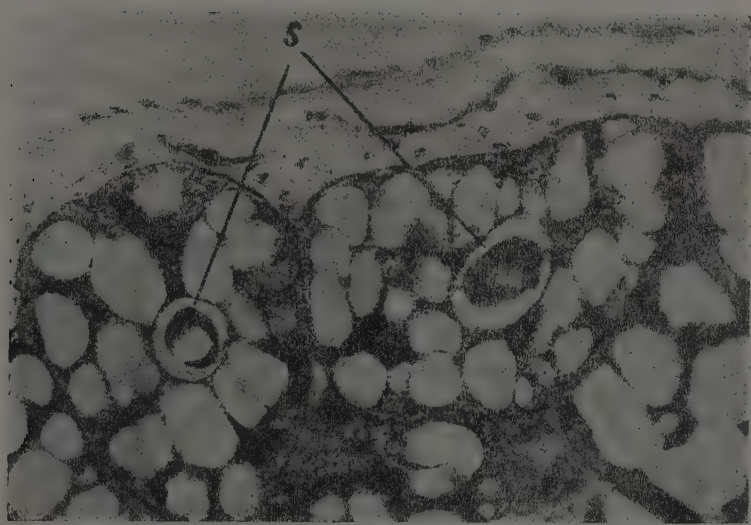


Fig. 3. — Transverse sections through the clusters of symbionts *s*. in the end cavities of 2 milk gland tubuli. The bacteria do not fill the whole width of the lumen but leave the central part free. Giemsa stain. × 450.

with the stomach contents in the anterior part of the larval stomach (Figs. 4 and 5). They disintegrate towards the posterior part of the intestine, probably on account of digestion by the larva. In other words, the bacteria in the milk glands of *Eucampsipoda aegyptia* seem to be a definite part of the larval food.

Milk glands which are the only place of localization of the symbionts in *Eucampsipoda aegyptia* are naturally missing in the male, and it was

Fig. 4. — Saggital section through the abdomen of *Eucampsipoda aegyptia* showing the position of the larva and the location of the milk gland: l.o., larval oesophagus; l.s., larval stomach; i.l., longitudinal, and i.t., transverse section through the blood filled intestine of the imago; m., milk gland tubuli. Giemsa stain. × 60.

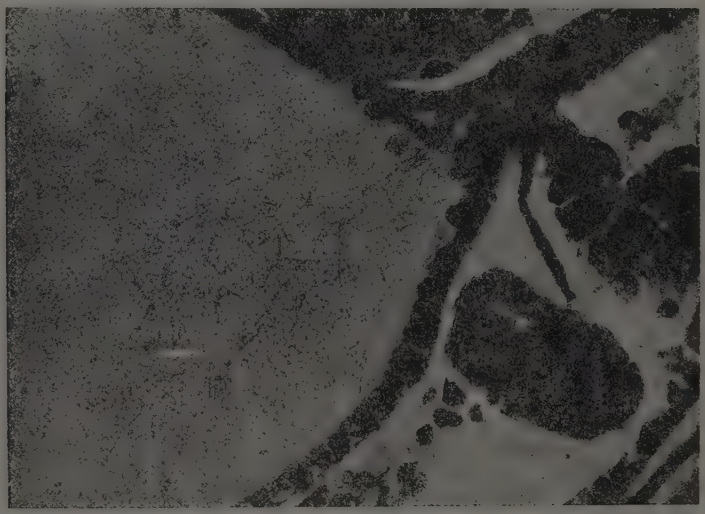


Fig. 5. — Part of anterior larval stomach showing the entrance of the symbionts through the oesophagus. Giemsa stain. × 450.

therefore of special interest to determine the behaviour of the symbionts in the male insect. Among the material examined by me were 2 males and, as was expected, they both proved to be entirely free from symbionts.

Discussion

Wigglesworth (1929) and Aschner (1931) drew attention to the fact that the blood-sucking Arthropoda which carry symbionts are only those which in the larval stage are entirely dependent on sterile blood or, as in the case of the Pupipara, on a sterile blood digest. They advanced the hypothesis that vertebrate blood is an insufficient food for a growing insect larva. Essential growth factors are missing or in too low a concentration in this substrate and it is the role of the symbionts to supply these factors or, as we would call them to-day, vitamins. According to this hypothesis, symbionts are necessary only to the growing larval stages, while imagines are less dependent on them. Symbionts must be present in the female so that their regular transmission to the offspring is safeguarded, but grown-up males should be able to do without them.

There is a certain amount of experimental evidence in support of this theory. It has been proved on the one hand, that symbionts are able to synthesize and supply certain vitamins of the B group to their hosts (Fraenkel and Blewett, 1943). On the other hand, Aschner and Ries (1933), and Aschner (1934) demonstrated that larvae of *Pediculus corporis* De Geer are unable to develop on their normal diet of human blood if they have been artificially freed from their symbionts. The behaviour of the symbionts of *Eucampsipoda aegyptia* forms an additional support for the above theory. This species demonstrates more clearly than could any experiment that the main role of the symbionts is in fact the nutrition of the larvae : the adult male does not live in symbiosis with bacteria and therefore obviously has no need for them. It is able to suppress entirely the development of the micro-organisms even though they are introduced into its stomach in large numbers during the larval stage. As to the female, there seems to be only one plausible explanation for the specific modification present in the milk gland : it is the logical answer to the need of the larva for an accessory food which is supplied by the bacteria. It is suggested that vertebrate blood, although in general not a poor vitamin source, is not rich enough in certain growth factors necessary for the normal development of quick growing larval stages of Arthropoda. The acquisition of vitamin-synthesizing bacteria by certain insects must therefore be regarded as having been an indispensable step in the development of those extreme cases of parasitism in which ability to thrive on vertebrate blood only characterizes the nutrition of the parasite throughout the life cycle.

Summary

The specific naure of the symbiotic relationship of *Eucampsipoda aegyptia* with bacteria lends support to the hypothesis that the main role of symbionts in blood sucking parasites is to supply certain vitamins to the growing larva.

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Aceria mangiferæ nov. spec. (*Eriophyes mangiferæ* Hassan MS)

[Acarina-Eriophyidae]

(with 6 Figures)

E.M.N.

by M. Taher Sayed,
A.R.C.S., B.Sc., D.I.C., Ph.D., F.F. 1st E.S.

Description

♀. — 225-250 μ long (rostrum included), 42-50 μ broad anteriorly; *shape* cylindrical, narrowed posteriorly; *colour* rather whitish or somewhat creamy.

Rostrum moderately long, about 20 μ.

Legs : 2 pairs placed anteriorly, six-jointed, about 42 μ long. Tarsi end in a six-rayed feather claw and three distal bristles, the exterior one being the longest. The bristle that lies between it and the claw ends with a knob and differs from the ordinary tenent hair of other acari. It is somewhat longer than the claw. Femora I and II carry a rather small bristle. The bristle on patella I is longer than that on patella II. Tibia I carries a short bristle which is missing on tibia II.

Thoracic setae : 3 pairs on coxae I and II. First pair very small, and situated with second pair on coxa I. The latter is about 17 μ long. The third thoracic seta lies on coxa II and is about 30 μ long.

Palpi with three unequal segments, the distal one being conical in shape and the smallest in size. It carries two small distal bristles and a comparatively long one laterally and on the exterior side. *Chelicera* fine, styliform, and lies between palpi.

Genitalia ventral and anterior in position, about 32 μ wide; genital seta 13 μ long, one pair just behind genitalia. The anterior apodème and the internal part of the female genitalia are shown in figure 3.

Dorsal setae one pair arising from the posterior part of the dorsal shield in the cephalothoracic area. Seta is as long as the genital one. The shield is triangular with a U-shaped structure and a vertical line inside it. The base of the U is well defined, and, moreover, there are two lateral lines. *Lateral setae* one pair, little to the rear of the genital setae and lie on the fourteenth

Explanation of Figures

Aceria mangiferae nov. spec.

Fig. 1. — The adult, ♀, ventral view : *a.s.*, accessory seta ; *c.s.*, caudal seta ; *d.s.*, dosral seta ; *l.s.*, lateral seta ; *th.I*, first thoracic seta ; *th.II*, second thoracic seta ; *th.III*, third thoracic seta ; *v.I*, first ventral seta ; *v.II*, second ventral seta ; *v.III*, third ventral seta. — × 436.

Fig. 2. — Legs I and II, and rostrum (palp + chelicerae).

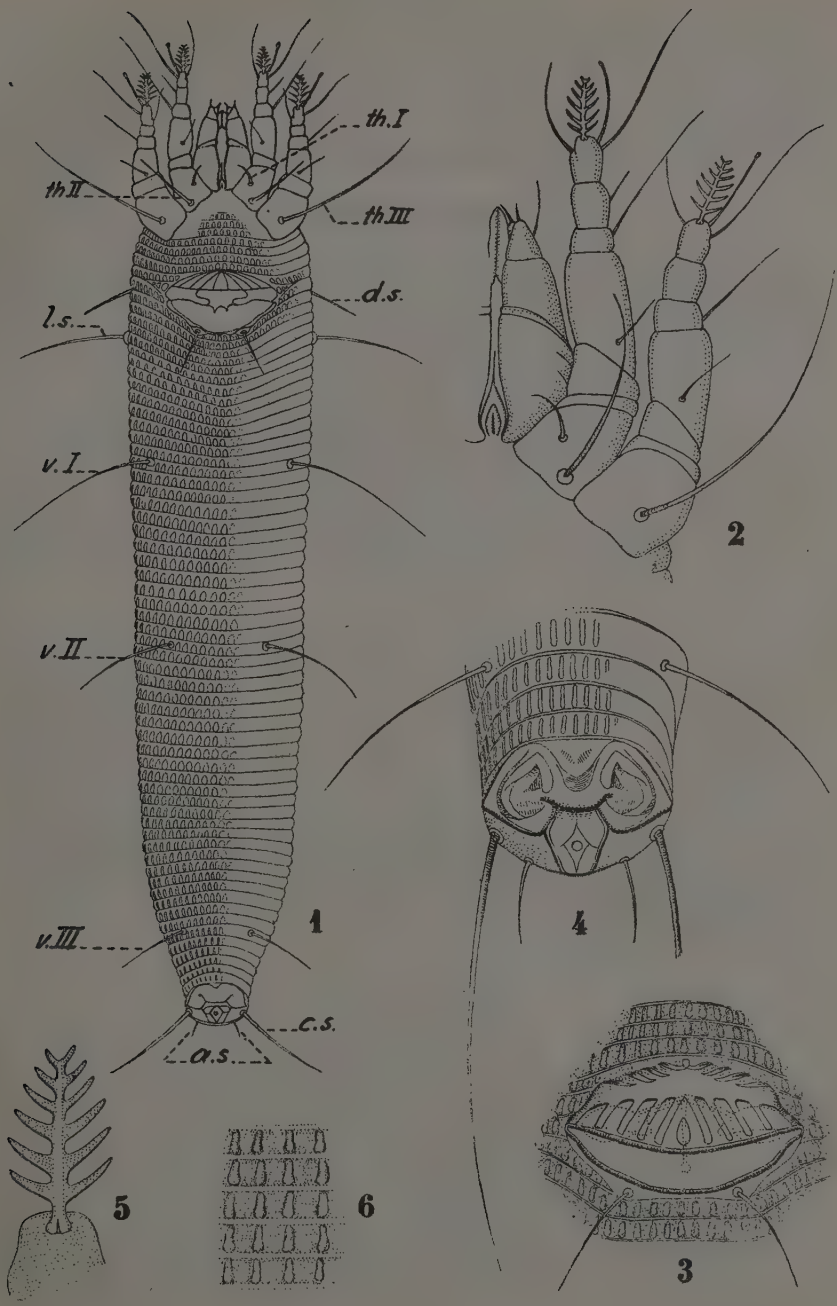
Fig. 3. — ♀ genitalia showing the internal part, the anterior apodeme, and the genital setae behind.

Fig. 4. — Caudal end with sucker, caudal setae, accessory setae, and third ventral setae.

Fig. 5. — Six-rayed feather claw.

Fig. 6. — Ventral structure of the skin.

Figures 2-6 are greatly enlarged


th.I
th.II
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d.s.
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ring anteriorly, 25 μ long. *Ventral setae* 3 pairs; first ventral or v.I is 30 μ long on the twenty-fourth ring anteriorly; v.II or second ventral, is about 13 rings behind v.I, and 25 μ long; v.III on ring 6 from the rear and 15 μ long. *Caudal setae* one pair at the extreme end of the body, 21 μ long. A pair of short accessory setae lie well behind and between the caudal setae.

General Remarks

(1) The mite attacks the terminal buds of young and old mango trees in both heavy and light soils. As a result of this infestation, the buds dry off and stop growing. Consequently, close lateral buds grow, but these are infested as well. Stem appears stunted and deformed in this area.

(2) In 1941 a survey was made in Sharkia province where most of mango trees grow, and the mite was found prevalent in the majority of gardens. However, the symptoms appear most amongst younger trees.

(3) Such symptoms were first described by Zeyadi and Serour (1930), but were attributed to *Scirtothips* (Thysanoptera).

(4) Physiological disturbances and scale insect of the genus *Lepidosaphes* (Coccoidea) when crowded round the terminal bud, might cause similar symptoms.

(5) The mite infests also the inflorescence which becomes deformed and rather rounded instead of the ordinary raceme type, and ultimately dry off. *Cryptoblabes gnidiella* Mill. (Lepidoptera Pyralidina : Pyralidae-Phycitinae) and *Stathmopoda auriferella* Wlk. (Lepidoptera Tineina : Elachistidae-Momphinae), both or one of them, is often found with the mite in the inflorescence.

(6) Hassan (1944) refers to *Eriophyes mangiferae* S.N. causing similar symptoms on mango trees. Unfortunately, he did not give any description of this new mite. However, Hassan (1934) in discussing Debski's work on plant galls admits (page 440) that « in giving a new name the mite should be of course fully described ».

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The Status of *Clausenia purpurea* Ishii and its Competition with other Parasites of *Pseudococcus comstocki* Kuw.[1] in Palestine

[Hymenoptera : Chalcidoidea-Encyrtidae,

and

Hemiptera-Homoptera : Coccoidea]

by E. Rivnay,
Agricultural Experiment Station,
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I. Foreword

In a recent paper Haeussler and Clancy (1944) have presented a survey of the enemies of the Comstock mealy-bug in the United States, briefly discussing their prevalence and their economic status there. The present writer, having followed the activities of *Clausenia purpurea* ever since its introduction into Palestine in 1941, was especially attracted to the status of this parasite in the United States, and upon studying the paper of Haeussler and Clancy finds it of extreme interest to Insect parasitologists, to compare its status in America with that of Palestine. In doing so the writer will at the same time give a brief survey of the status of the host *Ps. comstocki* and its parasites, as it is over five years today since the introduction of *Cl. purpurea* to this country. For, when the first report on *Clausenia* was published (Rivnay, 1942) the economic status of the species here was yet uncertain.

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(1) Since writing this paper, the writer visited the U.S.A. and discussed the identity of this mealy bug both with Dr. Morrison of the U.S. Department of Agriculture and with Prof. Ferris of Stanford University, California. Upon re-examination of material from Palestine, both are of the opinion that the Palestinian mealy bug is not that found in America As to which is the proper *Ps. comstocki* Kuw., Prof. Ferris claims to have in his collection Kuwana's material from Japan and finds the American species to be identical with it.

II. The Status in America

The following are the outstanding points one may obtain from the abovementioned report.

(1) The survey, upon which the report was based, was carried out in two North-Eastern, three South-Eastern and one mid-Western state. From Table I in that report it is apparent that *Clausenia* is active especially in the South-Eastern states, not being present in Ohio, and being of second-rate importance in Connecticut and New-Jersey. The question may be raised whether the climate in these states does not, to some extent, act as a hinderance in the work of *Clausenia*.

(2) In most localities parasitation has increased with each succeeding generation of the host in the summer, which may indicate that the climatic conditions of the summer are quite favourable for this parasite.

(3) From Table I it is apparent that the winter of even the South-Eastern states, Virginia, West Virginia and Georgia, is too hard on the parasite, for its suffers a considerable setback each spring.

(4) According to these writers, *Clausenia* does not check the infestation on apples, because the high rate of parasitation occurs only during the third generation, after the damage has been done.

(5) The writers state that *Clausenia purpurea*, « although extremely abundant in many orchards, is subject to severe attack by secondary parasites ».

III. The Host

The conditions of *Clausenia* in Palestine are different. However, before discussing them a few comments should be made about the host.

The morphological conformity of this species in Palestine and America is still a matter of doubt and confusion. This state adds additional interest to the following two characteristics of what is believed to bee *Pseudococcus comstocki* in Palestine.

(1) Although apple orchards were quite close to heavily infested citrus groves, as for instance at Mikveh Israel, yet apple trees were never infested with *Ps. comstocki* in Palestine. In America, this tree is a major host. Host selection should not serve as a definite criterion for specific distinction; we know of several polyphagous insects which select different hosts in different countries, yet in cases like this host selection may be a criterion.

(2) Together with *Clausenia*, Dr. Carmon brought us from Japan thousands of *Allotropa*, which, judging from the circumstances under which they were collected, are probably *A. burelli* Muesebeck [2]. These were

[2] During the recent visit of the author in the U.S.A., material of this insect was submitted to C.F.M. Muesebeck for comparison with the type specimen and he found them to be identical.

collected in Japan from pears infested with *Ps. comstocki*, and they were never collected on citrus trees. In Palestine, experiments, both in the grove and in the laboratory, failed to bring about parasitation of the Palestinian material by this species. In America, this species as well as another *Allotropa* parasitize the pest freely and in some places effectively. As for *Clausenia*, it apparently is a polyphagous insect parasitizing several long-tailed *Pseudococcus* which may be called the *comstocki* group.

Although *Ps. comstocki* in Palestine spreads further into new areas, nevertheless the infestation today is not of the same nature as it has been six or seven years ago. The grove which becomes newly infested with this pest does not show the pictures described by Bodenheimer (1938), Klein and Percelan (1940) and the writer at that time (Rivnay, 1939). Before assuming a serious aspect the pest becomes subdued and gradually diminishes from the grove to a minimum degree. Climatic conditions are not always responsible for this situation. Quite often two groves, one adjacent to the other, but one having become infested before the other, present two different pictures of degrees of infestation. In the one the pest is on the rise, in the other, on the decline. The exact reasons for this situation are still uncertain, and it is a pity that the opportunity to carry out a more accurate study was lost. Unfortunately, because of reasons not under the control of the students who carried out this study, the relative importance of biotic and climatic factors was not taken up thoroughly.

IV. Clausenia in Palestine

In Palestine the climate is so that the *Clausenia* is active almost throughout the year. The writer observed *Clausenia* actively in search for hosts during the months of March 1945, when it was much colder than it ordinarily is during this month in Palestine. Naturally, in April and May the activity of the Parasite is far greater, but the main point is that the winter does not bring the parasite to a stand still. During the summer too, conditions are not like in America, where the parasite may go on increasing uninterruptedly till the winter; but in the mid summer the high temperature brings a decline both in host and in its parasites. *Clausenia* resumes its high activity in September. Thus the insect has in Palestine two short periods of high activity separated from each other by short periods of decreased activity.

After *Clausenia* had become well established in a citrus grove in Palestine, *Ps. comstocki* no longer rises to the degree of a pest; this is unlike condition in America. Moreover, in many such groves it is difficult to find the host even when it is searched for diligently. For this reason, observations and counts regarding the extent of parasitation were impossible for periods longer than two years, or even less. A glance at the conditions of some groves will illustrate this distinctly.

A. The Mikveh Israel grove which was so heavily infested and in which *Clausenia* were liberated in 1940 (Rivnay, 1942), after hours of thorough search by a skilled person in May 1942 only one live *Ps. comstocki* was found and 9 mummies. Of these 3 *Clausenia* emerged; the others were dead. Ever since, *Clausenia* have ceased to be a problem for Mikveh Israel.

B. The Ginsburg grove at Rishon le-Zion, which was also badly infested in 1939-1940 and in which *Clausenia* were liberated in 1940, was very clean in May 1942. With difficulty could 20 females be found in April 1942: of these 13 of *Clausenia* emerged.

C. The Rivkind grove at Rishon le-Zion became infested much later than the above-mentioned. The writer discovered the pest early in 1941 on about half a dozen badly infested trees. 100 *Clausenia* were liberated in that section (A) of the grove in May 1941. Another section (B) became infested during the autumn of 1941, and *Clausenia* spread from section A to B. Counts of 250 individuals each month during the following winter and spring revealed the following percentage of parasitism by *Clausenia*:

Section A: 38 (January), 33 (February), 38 (March), 36 (April), 40 (May).

Section B: 18 (January), 8.8 (February), 4 (March), 6 (April), 36 (May).

During May no more than 25 individuals *Pseudococcus* could be found in Section A during a two hours search, and in the following month the pest could not be found in the grove at all. Since then, the pest has been no problem to these grove owners.

D. The Bilmes grove and the Smilansky grove at Rohovot were discovered to be infested with *Ps. comstocki* in 1943, the former in the spring, the latter in the autumn of the same year. *Clausenia* were liberated in both groves. From about 100 infested leaves collected in these groves in April 1944, 134 *Clausenia* were reared. *Ps. comstocki* can hardly be found in these groves.

E. The Makov grove at Rehovoth became infested in the spring of 1944; this grove is still under observation, but counts indicate that already from 10-20 % of non-ovipositing females are parasitized by *Clausenia purpurea* alone. Inspection during April 1945, show the pest to be in the decline.

One should not gather from all this that *Clausenia* alone is responsible for the prevalent situation. There are other factors acting towards the subduing of *Ps. comstocki* in Palestine.

First the climate should be mentioned. The warm and dry summer which acts unfavorably upon the *Clausenia* is still more detrimental to the host. A full discussion of this is given in an earlier paper (Rivnay and Percelan, 1943) where it is pointed out that from June to September

the pest is quite reduced in the citrus groves in Palestine. When parasites act efficiently one can readily see what the result of such combined blows from different directions may bring.

As far as enemies are concerned, again *Clausenia* is not the only one responsible for the blow. There are several *Scymnus* which are quite active from March to the end of May and which as pointed out in an earlier paper play an important role in reducing the pest. There are also other internal parasites which contributed to this cause. The decline of the pest in Mikveh Israel, for instance, began before *Clausenia* was introduced there. But in this connection it should be pointed out that wherever *Clausenia* is introduced, in a short time it assumes the leading role; and this phase the writer wished to discuss more at length.

It is a well established fact that quite often, when two or more insects feed on the same host plant or two or more parasites attack the same host the strongest under the circumstances will eventually become the dominating in the group.

There are several instances to illustrate this phase, the writer will mention only one illustration from the literature.

Willard (1930) points out that of the four parasites introduced into Hawaii to control the Mediterranean Fruit Fly, *Opius humilis* was leading during 1915 and 1916, but from 1917 to 1924 *Diachasma tryoni* was leading with the exception of 1923 when *Tetrastichus giffardianus* was the leading parasite.

V. Competition between enemies of Ps. comstocki in Palestine.

An illustration of this phase of competition between insects may be seen from the enemies of the *Ps. comstocki* in Palestine. Mainly three species of *Scymnus* participated in the destruction of this pest. They were *Sc. suturalis* Thunbg., *Sc. fenestratus* Sahlb., and *Sc. includens* Kirsch.. In Petah Tikvah it was evident that the most prevalent species was *Sc. fenestratus*, *suturalis* and *includens* missing (Klein and Percelan, 1940). Throughout the study at Mikveh Israel, *Sc. suturalis* and *Sc. includens* were in about equal numbers. In the Makov grove at Rehovot, however, we find *fenestratus* leading with *suturalis* rare, and *includens* altogether missing.

As far as the internal parasites are concerned, three local parasites were chiefly responsible for the parasitism of *Ps. comstocki* before *Clausenia* was introduced. They were *Leptomastidea abnormis* Gir., *Leptomastix flavus* Mercet, and *Anagyrus kivuensis* Comp.. *Leptomastidea abnormis* attacked only young larvae of the pest. Competition was, therefore, between *L. flavus* and *Anagyrus kivuensis*. As a rule *Leptomastix flavus* was the strongest. Wherever this parasite was present *Anagyrus* was in negligible numbers.

However, when *Leptomastix* was not present for some reason or other, *Anagyrus* was more prevalent. A few illustrations will be given : In Mikveh Israel and in all the groves of Rishon le-Zion, *Anagyrus* was in negligible numbers, and *Leptomastix* dominant. However, in one isolated yard in Tel-Aviv, a few trees were infested with the pest. The material from this locality was not infested with *Leptomastix flavus*, but *Anagyrus* were obtained in considerable numbers. The same situation was in the Bilmes grove where for some reason *L. flavus* did not become strong, and *Anagyrus* was the main parasite.

TABLE I

Parasites of Ps. comstocki *obtained in three Rehovot groves during two years.*

DATE	BILMES GROVE			SMILANSKY GROVE			MAKOV GROVE		
	A. kivuensis	*L. flavus*	*C. purpurea*	*A. kivuensis*	*L. flavus*	*C. purpurea*	*A. kivuensis*	*L. flavus*	*C. purpurea*
September 1943	85	24	15	31	94	0	—	—	—
October "	16	4	0	37	12	0	—	—	—
April 1944	0	0	34	0	0	47	0	2	0
June "	0	2	13	0	4	63	0	11	2
July "	—	—	—	—	—	—	0	24	0
October "	—	—	—	—	—	—	0	2	102
November "	—	—	—	—	—		1	0	41
December "	—	—	—	—	—	—	1	0	63
January 1945	—	—	—	—	—	—	0	0	234
March "	—	—	—	—	—	—	0	0	49

Of these two parasites *L. flavus* does not attack *Pseudococcus citri* while *Anagyrus* does so. We find that with *Ps. citri*, *Anagyrus* is far more prevalent than it is with *Ps. comstocki*.

After *Clausenia* was introduced into this complex, the situation became so that all other indigenous parasites shrank before this new immigrant. In

the aforementioned groves at Mikveh Israel and at Rishon le-Zion, it was observed that *Clausenia* developed rapidly, and little by little towards the end of two years, became the dominant parasite.

At Mikveh Israel, for instance, the three parasites together, *Leptomastidea abnormis* and *Leptomastix flavus* and *Anagyrus kivuensis*, caused over 30 % of parasitism, at one time, but at the end, when *Clausenia* established itself there these parasites diminished and almost disappeared.

The Ginsburg grove, too, was well populated with this three parasites, but in the end, in the spring of 1942, when counts of parasitism were made, only *Clausenia* were obtained from material collected there.

If *Clausenia* happens to invade a grove in the beginning of its infestation with *Pseudococcus comstocki*, this pest never assumes great importance.

The grove of Said Brothers at Sarafand may serve as an example. In the winter of 1942 a group of a dozen trees was discovered to be slightly infested. Apparently the beginning of the infestation occurred during the previous autumn. But also *Clausenia* invaded the grove a short time after the host. Counts of parasitism were made during February 1942; from 250 medium-sized females, 7 *Leptomastix flavus* and 2 *Clausenia* were bred. Similar counts were carried out in April of the same year, only 2 *Leptomastix* were obtained and 14 *Clausenia*. Subsequently it was very difficult to find the hosts in order to make further counts.

In the groves at Rehovot, counts of all parasites were made throughout the period of their infestation. The total numbers of parasites obtained in each of these counts are presented in Table I.

Discussion of Table I

In the Bilmes grove counts were undertaken some time after *Clausenia* had been liberated there. As observed of the local parasite *Anagyrus* was quite active in the autumn of 1943. The percentage of parasitism was then about 10 %. *Leptomastix* was less active, but *Clausenia* was already well established having accomplished about 2 % of parasitism of the host. By the following spring both local parasites disappeared and *Clausenia* remained.

The difference in the Smilansky grove is that *Leptomastix flavus* was the dominant indigenous parasite causing 10 % parasitism; *Anagyrus* being less active. But towards the spring, here too *Clausenia* became dominant.

In the Makov grove, *Clausenia* were liberated before local parasites were given a chance to rise. Consequently we find that *Anagyrus* hardly appeared on the scene, *Leptomastix* playing a very small role but *Clausenia* rising quickly, to bring about even a 20 % parasitism, and becoming practically the sole parasite there, in the course of one year.

Some of the factors which may be responsible for this situation are as follows :

(a) Climate : Apparently the two indigenous parasites are far less active during the winter and spring months than is *Clausenia*. In the grove, *Anagyrus* and *Leptomastix* appear only towards May (Rivnay and Percelan, 1943), where as the writer observed *Clausenia* to be active even in March; as long as the temperature is above 17° C., the parasite is capable of ovipositing (Rivnay, 1942).

During the summer, however, this situation is reversed. *Leptomastix* is more active than is *Clausenia*. But by that time, the Climate, Predators and Parasites have reduced the host to such a degree, that it is at its lowest affording no opportunity for *Leptomastix* to rise. With the approach of autumn, when the host rises again, the climate is again more favourable for *Clausenia* than it is for *Leptomastix*.

(b) Method of Reproduction : Both *Leptomastix flavus* and *Anagyrus kivuensis* are arrhenotokous insects, unfertilized eggs developing into males only. Quite often in breedings of material from the grove more males were obtained than females, as a rule the ratio of sexes was 1 : 1. *Clausenia purpurea* on the other hand produces females also from unfertilized eggs. In breedings both of laboratory and field material females were always far more abundent than males, and the ratio of the females to males was even higher more than 9 : 1.

(c) Hyperparasitism : As pointed out in an earlier paper, *Leptomastix* may be parasitized in turn by a *Thysanus* sp.. *Anagyrus*, it was recently discovered, is parasitized by *Achrysopophagus aegyptiacus* Mercet. For instance, in the Smilansky grove during the autumn of 1943, the number of *Achrysopophagus aegyptiacus* was about 1 :3 of the *Anagyrus*. It is quite possible that this was one cause to reduce *Anagyrus* there. As for *Clausenia* the situation is different. When this parasite was first introduced, about 50 % of the pupae brought from Japan were parasitized by a *Lygocerus* species. Careful breedings eliminated this species from the country. Breeding in the laboratory indicated that the *Thysanus* sp., whose host is *Leptomastix* may parasitize *Clausenia* too (Rivnay, 1942). Lately, also *Achrysopophagus* was tried, and it was found that in the laboratory it may attack *Clausenia* as well. However, in the field it is evident that no parasite attacks this species yet.

The relationship between *Clausenia* and the other local parasites in case of multiple parasitism is a subject for further study.

Summary

(1) The climate of Palestine in the Citrus region is not unfavorable to *Clausenia purpurea;* it may not be so in the United States in the apple regions.

(2) No parasite attacks *Clausenia* in Palestine. In the United States, it is attacked by other parasites.

(3) The summer in Palestine is unfavorable to the host, to a greater extent than it is to the parasite.

(4) *Clausenia purpurea*, after becoming established in a grove, before long, becomes the dominant or even the only internal parasite.

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The effect of Temperature on the Sex Ratio of Parasitic Hymenoptera

(with 3 Graphs, and 1 Figure)

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INTRODUCTION

The practice of utilizing cold storage in the shipping of insect parasites and the timing of their field liberation is of great importance in the practical application of biological control. Although many attempts to introduce and propagate parasites have failed, due to the inability of parasites to survive or reproduce after exposure to low temperatures, experimental work on the effect of such temperatures on the sex ratio and reproduction of parasites is still very meager. The importance of sex ratio in the mass propagation of parasites need not be emphasized. « A higher ratio of females will permit a more rapid increase in number of the rearing stock and will permit the production of a given number of females for colonization at lower cost and with less labor ». (Clausen, 1939).

The effect of low temperatures on the sex ratio of *Mormoniella vitripennis* (Walker) parasite on various Diptera, is outlined in this paper. The effect of such temperatures on the reproduction of the same parasite will be discussed in another paper.

MATERIALS, METHOD AND TECHNIQUE

A. Host rearing

A continuous supply of fresh standardized house fly puparia for the production of *Mormoniella vitripennis* is easily obtained through the method developed by Richardson (1937), after some modifications introduced by De Bach (1942). The number of puparia obtained daily ranged up to 1500, each collection had an age variation of 18 hours at laboratory temperature of 27.5° C.

B. Parasite rearing

300-400 puparia from two to three days old were exposed daily for a period of 18 hours to approximately 200 females of *Mormoniella vitripennis* in cloth covered one quart, wide mouth, Mason jars. Through this method a continuous supply of fresh parasites at all stages of development can be maintained.

C. Experimental technique

The experiments were designed to determine the effect, on the reproduction by *M. vitripennis* females of the F generation and on the sex ratio of the F1 generation, of exposure during larval, pupal and adult stages to temperatures of —8°, —1°, 6°, 11° and 16° C.

In each experiment the parasites were reared to one of the required stage of development and were then divided into five groups. Each group was stored at one of the five different temperatures in five glass tubes.

The tubes used in holding the parasites were 7.25 inches by 1 inch glass tubes, each having a waxed cork stopper and provided with a piece of moist cotton pinned on the inner side of the stopper in order to maintain the relative humidity at 100 %.

In the experiments on adults, each of the 25 tubes placed in storage contained about 50 mated females 2 days old. In experiments on full fed larval and pupal parasites, 50 to 60 parasitized host puparia were contained in each tube placed in storage. Each of the host puparia was cut open to make sure that the parasites were in the required stage of development. Tubes containing adult parasites were removed once every three days and placed in the laboratory for 2 hours for normal respiration and feeding on honey.

After each set of experiments was started, one tube from each group was removed from storage at intervals of 7 or 14 days. In the case of the mated females, stored as adults, 20 were isolated and placed separately in oviposition tubes and provided with host material. The immature stages were transferred to cloth covered 1-quart Mason jars and placed in the laboratory where the parasites could complete their development. When in the late pupal stage, the parasites were placed singly in gelatine capsules (No. 0). Following their emergence about 20 pairs of parasites, 1 male and 1 female each, were placed separately in oviposition tubes, where they were allowd to mate and feed for 24 hours before being provided with the first host material.

The oviposition tubes were 3.75 inches by 1 inch celluloid tubes, provided with honey and closed with tin caps. Each female was provided daily with 3 host puparia 2 to 3 days old. The puparia parasitized by each female were placed in a gelatine capsule (No. 000), marked with the date of expo-

sure, and stored in a celluloid tube marked with the number of female. Through this means the daily progeny for each female were counted.

The sex ratio of females to 1 male was calculated from the total number of females and males composing the progeny of each female. Sex ratios of the progeny of all females used were averaged.

Likewise the number given for the progeny per female at each exposure period represented the average of those of all females used, including those not producing progeny.

The averages obtained at each exposure were compared with those of 39 females reared at the start of this work from egg to adult at 27.5° C. The averages obtained from these females were considered to be the normal averages at this temperature and were used as a basis for comparison throughout the present work.

The progeny of 1877 females numbering 140982 individuals were observed and tested. In addition 13428 parasites in their immature stages were also tested.

Sex ratio of Mormoniella

The average sex ratio of the total progeny of 39 females reared on *Musca domestica* at 27.5° C. was found to be 4.8 : 1. A sex ratio of 1 : 1 to 2 : 1 is obtained however, when the parasite is reared in mass, exposing 300 to 400 host pupae for 18 hours to approximately 200 female parasites. This low sex ratio is probably due to the effect of superparasitism and elimination of females.

SEX DETERMINATION AND FACTORS AFFECTING SEX RATIO IN HYMENOPTERA

A. Sex Determination in Hymenoptera

In the Hymenoptera, females arise from fertilized eggs or they may develop parthenogenetically as is the case in thelyotokous and dueterotokous species. In any case, the females are diploid. Males are haploid and always arise from unfertilized eggs. All the sperms from any one male are alike, no matter how mixed the race from which he comes.

In arrhenotokous species, all unfertilized eggs, with very few exceptions, become males and all the fertilized eggs become females. The sperms are only female-producing and the control of sex resolves itself into the control of fertilization.

B. Sex-changing Mechanism

Flanders (1939 a, 1939 b) discusses the sex-changing mechanism in arrhenotokous species. The following is a summary of this work.

This mechanism consists of the spermatheca, its gland and duct and the associated nerves and muscles. « Its primary function is to discharge a limited number of activated sperms as the egg passes down the oviduct ... Since male progeny also are produced by the female before its supply of sperms is exhausted, it is evident that some stimulus other than the mere passage of the egg through the oviduct is needed to cause the discharge of sperms ». This operation appears to depend on two sets of reflexes, one involving the spermathecal gland (the stimuli originating externally) the other involving the spermathecal muscles (the stimuli originating internally) with the movement of the egg through the oviduct. « The glandular reflex apparently serves to activate the sperms, the muscular reflex apparently synchronizes the discharge of sperms with the expulsion of the egg ».

C. Factors Affecting the Sex Ratio

Any factors that interfere with the normal functioning of the above mentioned process will automatically produce a change in the sex ratio of the progeny of the ovipositing female. Such factors may be internal or external and, therefore, the change in sex ratio may be internally influenced due to a change in the physiological or psychological condition of the female; or externally influenced due to the effect of the outside environment.

a. Internal Factors

1. *Mating.* — Females of many parasite species will oviposit as readily whether their spermatheca contains sperms or not, e.g., *Mormoniella vitripennis*. This results in a high proportion of males among their progeny. Unmated females of some species, on the other hand, tend to refrain from ovipositing. In *Melittobia acasta*, unmated females lay fewer eggs than mated ones. This results in high proportion of females among their progeny (Parker and Thompson, 1928).

2. *Rate of Oviposition.* — When a female deposits its eggs in rapid succession, a number of eggs, which otherwise would be fertilized, escape fertilization as a result of the depletion of secretions of the spermathecal gland or tetanization of spermathecal muscles (Flanders, 1939 a).

Under these conditions the sex ratio is, at least in part, internally influenced.

b. External Factors

1. *Host insect.* — Clausen (1939) pointed out that the sex ratio will vary with « 1, the sex ratio of the host; 2, with successive generations upon the same or different host generations; 3, with different hosts; 4, upon the

same host and in the same season but in different geographical regions; 5, in successive years when the host population is increasing or declining rapidly. Increase in host density is often reflected in a reduction in size of individuals with a consequent influence on the sex ratio of the parasite ».

2. *Differential deposition.* — In many aphelinids, males and females are limited to different types of hosts and therefore the ratio of the two types of hosts affect the sex ratio of parasite (Flanders, 1941).

3. *Kind of food consumed by female.* — Flanders (1942) observed that females of *Habrolepis rouxi* produce more males when parasitizing red scale grown on gourds than when parasitizing red scale grown on lemon.

4. *Differential mortality of the sexes.* — Vandel (1932) states that in cases of superparasitism male sex predominates, through selective mortality of the females. Temperature may produce a similar effect, as will be discussed later.

5. *Starvation.* — Holdaway (1930) and Holdaway and Smith (1933) claim that in *Tribolium confusum* the sex ratio found in newly hatched unfed larvae is altered by starvation. One day of starvation leads to a statistically insignificant preponderance of males; two or three days starvation to a statistically significant preponderance of females. The changes are not due to selective mortality, since the change in sex ratio was considerably larger than the total mortality.

6. *Temperature.*

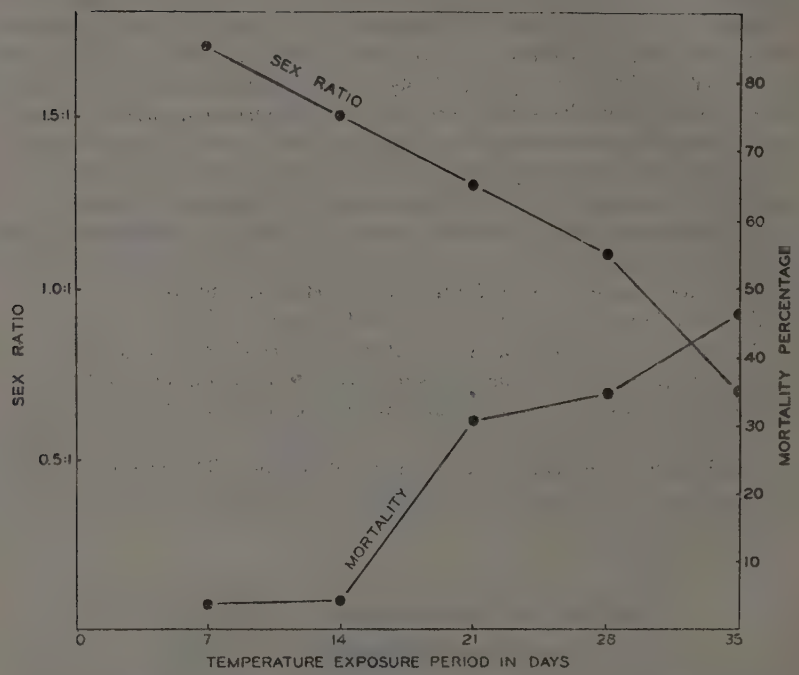
EFFECT OF TEMPERATURE ON SEX RATIO

AA. Direct effect of temperature on sex ratio

Temperatures ranging from —8° to 16° C. exhibit no differential effect on any of the sexes of *Mormoniella* when they are exposed to these temperatures during the pupal stage. There is no correlation between the sex ratio of adults that succeeded in emerging and in the degree of mortality among the immature stages. When *Mormoniella*, however, is exposed during the full grown larval stage to 6° and —1° C., there is a gradual increase of the proportion of adult males that succeeded in reaching maturity, and this is correlated with the period of exposure and the mortality percentage among the immature stages. Female larvae seem to be less resistant to these temperatures than male larvae and thus there is a greater mortality of females over males, giving an excess of males, when the parasites emerged at 27.5° C. (Graph I).

Schread and Garman (1933) arrived at the same conclusion by refrigeration of *Trichogramma* parasitized grain moth eggs at 38° F. The parasites were incubated at 80° F. for 4 days before being subjected to refrigeration and were probably in the prepupal stage.

GRAPH I



Effect of selective mortality on the sex ratio of emerging adults when full-grown larvae of *Mormoniella vitripennis* are exposed to 6° C. and 100 per cent R.H.

(Based on the study of 592 full-grown larvae).

BB. Indirect effect of temperature on sex ratio

Introduction

Low temperatures may upset the normal sex ratio of an insect. We have discussed how selective mortality caused by exposures to such temperatures may bring about that change. Here we shall confine ourselves to those changes in sex ratio as brought about by biological defects in males or females that have been subjected during their larval, pupal and adult stages to low or high temperatures.

Schread and Garman (1934) demonstrated that the sex ratio of *Trichogramma* is upset when temperatures below 47° F. are employed in

refrigeration, and that the change is more evident, however, in the generation following than in the generation emerging from refrigerated parasites.

Hanna (1935) showed that when full-grown larvae of *Euchalcidia caryobori* are exposed to a temperature of 16° C. for 55 days, there was no change in sex ratio of the progeny of emerging adults. When, however, pupae of the parasite are exposed to the same temperature, there was a remarkable change in sex ratio after 10 days exposure, due to the sterility of males.

The results of the author's work on *Mormoniella* are presented in the following paragraphs :

A. *The effect on the sex ratio of the F1 generation of exposing adults of* Mormoniella *to low temperature.*

Storing mated females 2 days old at 11° C. for 49 days and at 6° C. for 63 days, does not seem to have any appreciable effect on the sex ratio of their progeny. The sex ratios of the progeny were 4.2 : 1, 4.0 : 1, 5.7 : 1, 4.3 ; 1 and 4.5 : 1 after 14, 21, 35, 49 and 63 days exposure to 6° C. They were 4.5 : 1, 4.4 : 1, 4.4 : 1 and 4.9 : 1 after 14, 21, 35 and 49 days exposure to 11° C. When females are exposed, however, to either higher temperatures (16° C.) or lower temperatures (—8° C. or — 1° C.), there is a significant change in the sex ratio of the progeny.

At —8° C. there is a gradual change from a normal sex ratio of the progeny to 2.7 : 1 and to 2.0 : 1 after 3 and 5 days exposures of females to this temperature, respectively. The average sex ratio of the progeny of female reared from egg to adult at 27.5° C. is 4.8 : 1. This change is due to the effect of this temperature on the sperms in the spermathecae as well as on the females. This is illustrated by the fact that when males that were subjected to —8° C. for 3 days were mated with normal females that were reared throughout at 27.5° C., they gave progeny with a significantly low sex ratio of 2.3 : 1. At the same time, females that were exposed to —8° C. for 3 days and then mated with normal males that were reared throughout at 27.5° C., gave progeny with an average sex ratio of 2.4 : 1. In the last case, however, only 6 females out of 27 used mated successfully with normal males, while the remainder refused to mate ; indicating that even such short exposures to low temperatures may produce a radical change in the behavior of females.

At —1° C., the sex ratios of the progeny were 4.5 : 1, 2.7 : 1, 2.2 : 1, after 14, 21 and 35 days exposure of females, respectively. The results of crossing normal females with males that were exposed to this temperature for 25 days gave progeny with a significantly low sex ratio of 2.6 : 1 in-

dicating that extended exposures to —1° C. may also have an adverse effect on the sperms.

It was not possible, however, to show whether such a temperature may produce a biological defect in females or not, since out of 20 virgin females exposed to this temperature for 25 days, only 1 successfully mated with normal males, though the remainder had every chance to mate.

When mated females are exposed to a temperature of 16° C., the sex ratios of the progeny were 5.1 : 1, 2.6 : 1, and 2.7 : 1 after 14, 21 and 35 days exposure, respectively. The crossing of males, that were stored at 16° C. for 28 days, with normal females gave a sex ratio among the progeny of 5.4 : 1, indicating no adverse effect on the sperme. When, however, normal males mated with females stored at 16° C. for 28 days, the sex ratio of the progeny was 2.3 : 1 showing that females exposed to this temperature over this period of time are adversely affected.

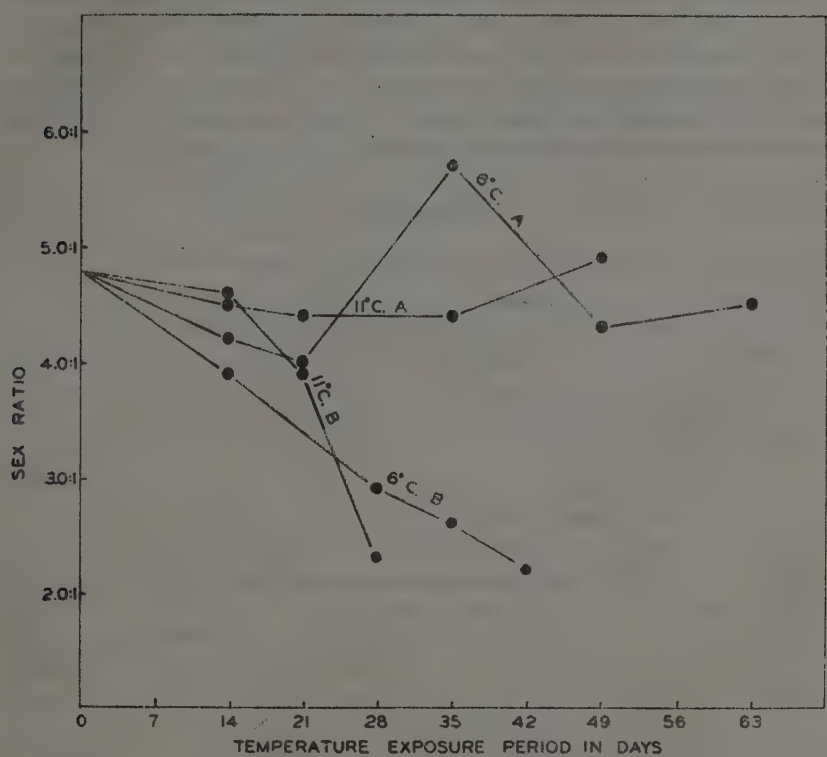
B. *Effect on the sex ratio of the F1 generation of temporary starvation of adults.*

It has been shown that the sex ratio of the progeny of mated females exposed to either 6° C. for 63 days or 11° C. for 49 days, but allowed to feed for 2 hours on honey every 3 days at 27.5° C. show no significant change. The sex ratio of the progeny of mated females exposed to the same temperatures but allowed no food exhibit a significant change (Graph II). The sex ratios of the progeny of the latter were 3.9 : 1, 2.9 : 1, 2.6 : 1 and 2.2 : 1 after 14, 28, 35 and 42 days exposure, respectively, to 6° C. They were 4.6 : 1, 3.9 : 1 and 2.3 : 1 after 14, 21 and 28 days exposure to 11° C. Since temperatures of 6° C. and 11° C. do not adversely affect the sperms, as has already been pointed out, and since in every case sperms were always seen active in the spermathecae of starved females, when the latter were dissected in physiological salt solutions, the gradual decline in the sex ratio of the progeny of these females must be due to some form of defect in the latter.

C. *Effect of low temperatures on mating.*

It has been pointed out that out of 27 virgin females stored at —8° C. for 3 days, 21 refused to mate and that out of 20 virgin females exposed to —1° C. for 25 days, only 1 successfully mated with normal males, though the rest of them had every chance to mate. It may be interesting to note that virgin females exposed to 11° C. for 49 days mated readily with normal males, indicating that the lack of mating on the part of these females is not in any way due to aging, but to the effect of the temperatures used. Flanders (unpublished notes on *Physcus testaceous*) noticed that 8 females

GRAPH II



Effect on the sex ratio of the F1 generation of exposing adult mated females of *Mormoniella vitripennis* to 6° and 11° C. and 100 per cent R. H.: A. Adults placed in the laboratory every 3 days for 2 hours for normal respiration and feeding on honey; B. Adults placed in the laboratory every 3 days for 2 hours for normal respiration but allowed no food.

(Based on the study of the progeny of 310 females, numbering 18.908 individuals).

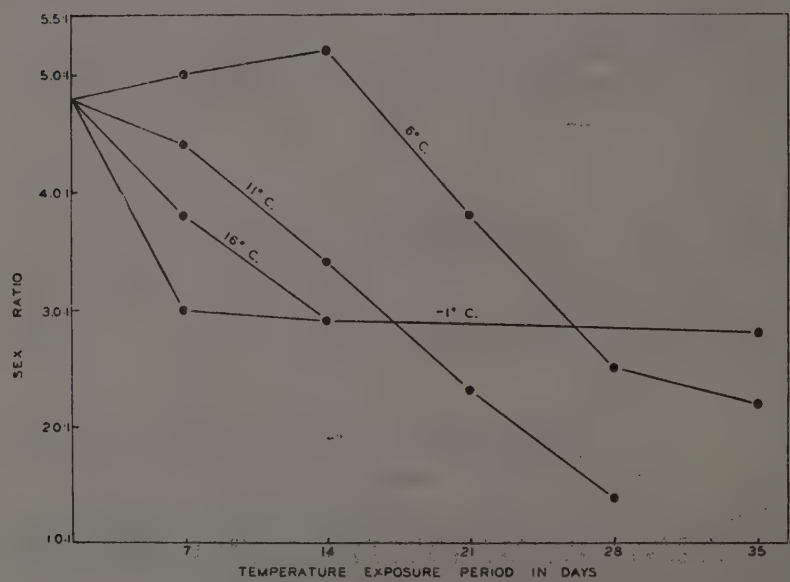
of a non-overwintering generation of this parasite that had been subjected in their pupal stage to 50° F. for 2 weeks, refused to mate. This has a very important bearing on the sex ratio of the progeny in those species which oviposit as readily with or without mating.

D. *Effect on the sex ratio of the F1 generation of exposing newly formed and advanced pupae of* Mormoniella *to low temperatures.*

When newly-formed or advanced pupae of *Mormoniella* are exposed to temperatures ranging from —1° C. to 16° C. for increasing periods, there

is generally a gradual decrease in the sex ratio of the succeeding generation. The degree of that change is correlated with the period of exposure (Graph III). That decline in sex ratio is due to defects produced in the male parents by all temperatures and in the male and female parents only by comparatively high temperatures (11° C. and 16° C.), as shown by the low sex ratios of the progeny of males exposed to these temperatures during their pupal stage and mated with normal females and vice versa.

GRAPH III



Effect on the sex ratio of the F1 generation when newly formed pupae of *Mormoniella vitripennis* are exposed to different temperatures and 100 per cent R. H.

(Based on the study of the progeny of 300 females numbering 24.732 individuals).

a. Newly formed pupae

The sex ratios of the progeny of females exposed during their early pupal stage to —1° C. for 7, 14 and 35 days showed a gradual change from a normal sex radio to 3.0:1, 2.9:1 and 2.8:1. When males that were stored during their pupal development at —1° C. for 35 days were allowed to mate with normal females the sex ratio of the progeny was 1.4:1 indicating that such males were at least partially sterile. When, however,

females that were exposed during their pupal development to —1° C. for 35 days were allowed to mate with normal males the sex ratio of the progeny was low, 3.9 : 1, though not statistically significant.

The sex ratios of the progeny of females exposed during their early pupal development to 6° C. for 7, 14, 21, 28 and 35 days were 5.0 : 1, 5.2 : 1, 3.8 : 1, 2.5 : 1 and 2.2 : 1. The sex ratio of the progeny of males stored at 6° C. for 35 days during their pupal development and mated with normal females was significantly low, 1.9 : 1. The sex ratio of the progeny of female exposed to this temperature for 35 days during their pupal development and mated with normal males was 5.5 : 1.

At 11° C. the sex ratios of the progeny were 4.4 : 1, 3.4 : 1, 2.3 : 1 and 1.4 : 1 after 7, 14, 21 and 28 days exposure. When males stored for 28 days at this temperature during their pupal development were allowed to mate with normal females the sex ratio of the progeny was 1.6 : 1.

When, however, females stored at the same stage for the same period were allowed to mate with normal males, the sex ratio of the progeny was low, 1.4 : 1.

At 16° C. the sex ratios of the progeny were 3.8 : 1 and 2.9 : 1 after 7 and 14 days exposure. Since at 16° C. full-grown larvae readily change into pupae, some full grown larvae were stored at this temperature for a period of 19 days. At the end of this period all of the parasites were in the advanced pupal stage. When the emerging males were crossed with normal females the sex ratio of the progeny was 1.6 : 1. Some of the males showed complete sterility with few scattered sperms in the vesticulae seminalis or none at all. When the emerging females were crossed with normal males, the sex ratio of the progeny was still significantly low, 2.5 : 1.

b. Advanced pupae

The sex ratios of the progeny of females stored during their advanced pupal stage at —1° C. for 7, 14 and 21 days showed a gradual change from a normal sex ratio of 4.8 : 1 to 3.1 : 1, 3.1 : 1 and 2.7 : 1.

At 6° C. the sex ratios of the progeny were 2.9 : 1, 3.0 : 1 and 3.3 : 1.

At 11° C. the sex ratios of the progeny were 4.6 : 1, 3.5 : 1 and 2.1 : 1.

E. *Effect on the sex ratio of the F1 Generation of exposing larvae of* Mormoniella *to low temperature.*

a. Full-grown larvae

The sex ratios of the progeny of larvae stored at both 16° C. and 11° C. showed a gradual change to 3.1 : 1, 2.0 : 1 and 2.1 : 1 after 7, 14 and 21 days storage, respectively, at the first temperature (16° C.) ; and a change

to 3.5 : 1, 2.4 : 1, 2.9 : 1 and 2.7 : 1 after 7, 14, 21 and 28 days storage at the second temperature (11° C.). There was no significant change in the sex ratios of the progeny of larvae stored at 6° C., — 1° C. and — 8° C., excluding the sex ratio of 3.3 : 1 obtained when larvae exposed to —8° C. for 14 days yielded only 2 females able to reproduce. An average of only 12 individuals was obtained. The sex ratio of the progeny of larvae stored at —1° C. for 7, 14, 28 and 35 days was 4.4 : 1, 4.0 : 1, 4.3 : 1 and 4.8 : 1 respectively. The sex ratio of the progeny of larvae stored at 6° C. for 7, 14, 21, 28 and 35 days was 4.0 : 1, 4.7 : 1, 4.0 : 1, 4.4 : 1 and 4.5 : 1 respectively.

b. Feeding Larvae

Since full-grown larvae readily change into pupae at both 11° C. and 16° C., it was thought advisable to find the effect of exposing immature larvae to low temperatures on the sex ratio of the progeny. Only the sex ratios of progeny of feeding larvae stored at 16° C. and 11° C. show any appreciable change. Crossing males that were subjected to 11° C. for 21 days with normal females gave progeny with a sex ratio of 1.4 : 1 indicating that even exposure of the feeding larval stages to moderately low temperatures (11° C.) may produce an adverse effect on the fertility of the emerging males.

It is rather interesting to point out that only at 11° C. and 16° C. does the parasite continue to grow, develop and show any signs of metamorphosis. At temperatures of 6° C., —1° C. and —8° C. there seems to be no signs of development or metamorphosis, even after 35 days exposure in the first two temperatures. It is also significant that though spermatogenesis does not set in before pupation, the spermatogonia coninue to divide and increase in numbers throughout the larval stage.

F. *Conclusions.*

The results of the preceding experiments indicate that :

(a) The sex ratio of the progeny of parents exposed to temperatures ranging from —8° to 16° C. is not affected when the parents are exposed as full-grown or feeding larvae to temperatures below 11° C. At these temperatures, development proceeds at a minimum ; or when the parents are exposed as adults to 6° C. for 63 days or 11° C., for 49 days, and allowed to feed every 3 days for 2 hours on honey.

(b) The change in sex ratio, if there is any change, among the progeny of exposed parasites is gradual and generally correlated with the temperature exposure period.

(c) The decline in sex ratio is due to partial or complete sterility of males, adverse effect on the sperms or certain biological defects in females.

G. *Causes of Changes in Sex Ratio due to Temperature.*

We have seen above how exposures to low temperatures may bring about a change in sex ratio of the succeeding generation of parasites. Since *Mormoniella* is arrhenotokous, the preponderance of males among the progeny of depositing females must be due to a preponderance of unfertilized eggs; a large number of the eggs which otherwise would be fertilized escape fertilization, a condition which may be brought about by :

Weakness or death of sperms in spermathecae of mated females or the vesiculae seminalis of males, when exposed to low temperatures.

Partial or complete sterility of emerging males when exposed during the immature stages to low temperatures.

The failure of sperms to reach the eggs of the ovipositing female.

The failure of the fertilization process itself.

In other words, the preponderance of males among the progeny may be due, as it has already been shown, to a biological defect in males or females.

a. Biological defects produced in males.

1. *The effect on the sperms*

That low temperatures may affect the viability of sperms has been shown by various workers. Flanders (1938) noticed that the vesiculae seminalis of males of *Tetrastichus* sp., kept for 14 days at 38° F., were filled with spermatozoa, but viability of spermatozoa varied in different individuals; being active in some and sluggish or inactive in others. Viability of sperms in vesiculae seminalis of males of *Mormoniella* exposed to —8° C. for 5 days varied in different individuals. Sperms of *Mormoniella* seem to be less resistant to low temperatures than to high temperatures. Sperms in the spermathecae of females stored for 35 days at 16° C., for 49 days at 11° C., and for 63 days at 6° C. are not adversely affected; sperms in the vesiculae seminalis of males or spermathecae of females stored at —8° C. for 3 days or —1° C. for 25 days were seriously affected.

Even very short exposures to very low temperatures may affect the fertility of males. Voelkel (1924) found that when males of the beetle *Trogoderma granarium* were exposed to a temperature of —8° C. for 3 hours, their fertility was not affected. Males kept at —8° C. for 30 hours, however, were sterile.

2. *Effect on the tissues of the testes*

The effect of low temperature is not only limited to the sperms, but they also may affect the tissues of the testes before the formation of the

sperms that their subsequent formation may be delayed or hindered partially or entirely.

When *Euchalcidia caryobori* is exposed in the pupal stage to a temperature of 16° C., the percentages of sterile males were 70, 90 and 100 after 10, 25 and 40 days exposure (Hanna, 1935). The vesiculae seminalis of many males of *Mormoniella* exposed in the full-grown larval stage to 16° C. for 21 days, contained very few scattered sperms (Figure 1). The effect of exposing newly formed pupae of *Mormoniella* on the partial sterility of males has already been discussed.

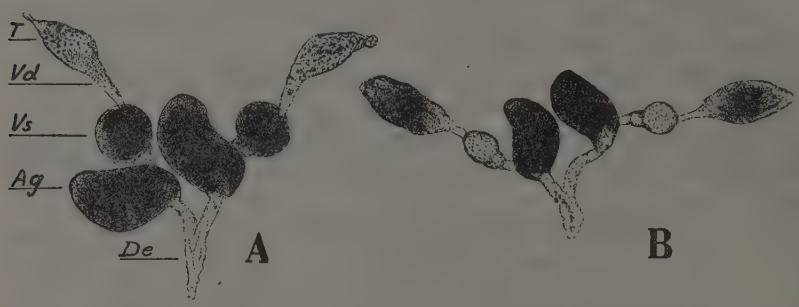


Fig. 1: A. Male reproductive organs of *Mormoniella vitripennis* removed from a male 2 days old. Darkness of vesicula seminalis indicates abundance of sperms; B. Same, male was exposed during the larval stage for 21 days at 16° C. Lightness of vesicula seminalis indicates the lack or the presence of few scattered sperms.

Hanna's histological work on the testes of males of *Euchalcidia* exposed during the pupal stage to a temperature of 16° C. for 10, 25 and 40 days, shows that the spermatozoa in the testes of the first group were fewer than in the normal, and that premetamorphic cells were not frequent. In the second group, spermatozoa were few and premetamorphic cells abundant and in the third group spermatozoa were very few indeed and the testes was full of premetamorphic cells. In the second and third groups, distinct signs of degeneration were shown by the premetamorphic cells. It may be gathered, he concludes, that « low temperatures cause at least the retardation of spermatogenesis. In its extreme effect, it may cause the degeneration of the premetamorphic cells ».

Nor is the effect on the fertility of males limited to low temperatures, exposure to high temperatures may produce a similar effect. When *Drosophila* was reared at 32° C., 96 per cent of the males and only 50 per cent of females were sterile (Young and Plough, 1926). Norris (1933) concludes that the sterility of *Ephestia kuehniella* at high temperatures was

due to an abnormality on the part of males only. Ijima (1940 a, 1940 b, and 1941) demonstrated that when the sugar cane borer, *Eucosma schistaceana*, is exposed during the egg, larval and pupal stages to a temperature of 32° C., 31.47, 92.23 and 100 per cent of the males were sterile. Females, with but few exposed in the pupal stage, were little affected. Some of the sterile males exposed in the larval stage recovered their reproductive powers within a period of 7 to 17 days. When pupae were kept at 32° C. for 8 hours during the day and 27 to 30° C. at night, for a period over 16 days, males were rendered entirely sterile.

b. Biological defects produced in females.

The change in sex ratio, however, is not only due to abnormalities on the part of males, exposures to low temperatures may cause certain abnormalities on the part of females, resulting in a preponderance of males among their progeny.

The importance of stimulation of spermathecal gland, spermathecal secretions and spermathecal nerves and muscles in the process of fertilization has already been discussed. An increase in the proportion of unfertilized eggs, due to the failure of sperms to reach the eggs, may result from :

Inadequate stimulation of spermathecal gland.

Depletion of spermathecal secretions.

Failure of spermathecal nerves and muscles to function or synchronize the discharge of sperms with the expulsion of eggs through the oviduct.

« The stimulation of the spermatheca probably results from the contact of the antennae, legs or ovipositor with the medium on which the eggs are to be deposited. Variations in the condition of this medium may vary the amount of stimulation and it is probable that the spermatheca responds only to stimuli of certain intensities, reacting to its fullest extent or not at all » (Flanders, 1939 a). Since individuals of the same species of parasite may vary in their response to the same host, it is very probable that females exposed to low temperatures may, on the average, vary in their response to their hosts from those that have not been so exposed and that this variation may cause a difference in the degree of stimulation of their spermathecae. We have seen before how females exposed during their immature and adult stages refused to mate with normal males when placed at normal temperatures.

Whether the activity of the spermathecal gland or the spermathecal muscles and nerves are affected and to what extent they would be affected by low temperature is difficult to determine. It is more likely, however, that low temperatures may adversely affect the general health and well being of the organism.

One further probability is that low temperatures may still produce a change in the sex of the egg long before fertilization.

ACKNOWLEDGMENTS

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The effect of Temperature on Development and Reproduction of *Mormoniella vitripennis* (Walker)

[Hymenoptera : Chalcidoidea-Pteromalidae]

(with 3 Figures, and 5 Graphs)

by A. A. Moursi (B.S., M.S., Ph. D.),
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INTRODUCTION

In my previous paper published in this Bulletin (pp. 21-37), I have discussed the effect of temperature on the sex ratio of *Mormoniella vitripennis* (Walker) as well as the materials, method and technique employed. The effect of low temperature on the reproduction of the same parasite is outlined in this paper.

I would like to add that in the following experiments the number given for the progeny per female at each exposure represented the average of those of 20 females used, including those not producing progeny. The average obtained at each exposure was compared with that of 39 females reared from egg to adult at 27.5° C. The average obtained from these females was considered to be the normal average at this temperature and was used as basis for comparison throughout the present work.

BIOLOGY OF MORMONIELLA VITRIPENNIS (WALKER)

The biology of *Mormoniella vitripennis* (Walker) (*Nasonia brevicornis* Ashm. [Gahan, A.B., 1927, *Proc. U. S. Nat. Mus.*, Vol. 71, Art. 4, No. 2676]) was studied by Girault and Sanders (1909 and 1910), Froggatt and McCarthy (1914), Roubaud (1917), Altson (1920), Tiegs (1922), Parker (1924), Parker and Thompson (1928), Evans (1933), Cousin (1933), and Fukuda (1939). The following summary is based on these studies, in so far as they pertain to the problem at hand, and on the personal studies of the author.

A. Hosts attacked

Mormoniella vitripennis is a polyphagous gregarious external pupal parasite of many Diptera. The following is a list of the various species on which the parasite was recorded as able to complete its development :

Chrysomia macellaria, Musca domestica, Phormia regina, Scarcophaga sp., and *Synomyia cadaverina* (Girault and Sanders, 1909 and 1910) ; *Calliphora erythrocephala, C. rufifacies, C. villosa, C. oceaniae, Lucilia sericata, Ophyria nigra,* and *Sarcophaga aurifrons* (Froggatt and Mc Carthy, 1914) ; *Calliphora erythrocephala, Musca domestica,* and *Phormia sordida* (Roubaud, 1917) ; *Calliphora erythrocephala, Lucilia sericata,* and *Lucilia bufonivora* (Cousin, 1933) ; *Sturmia sericariae,* a tachinid parasite of the silkworm chrysalids (Fukuda, 1939).

Roubaud noticed that larvae of *Mormoniella* although able to complete their development on pupae of *Gastrophilus intestinalis* and *Glossina morsitans*, were not able to make their way out of host puparia. A similar observation was made by Cousin on *Sarcophaga carnaria* and by Parker and Thompson on *Musca domestica.*

Parker and Thompson reported the parasite deposited eggs in cocoons formed by the European corn borer parasite *Eulimnaria crassifemur. M. vitripennis* was claimed by Cousin to deposit eggs within pupae of the two Pyralidina, *Galleria mellonella* and *Achroia grisella*, the larvae dying after attaining various stages of development.

B. Life-cycle

The duration of the immature stages varies with temperature. Under the conditions of the laboratory of 27.5° C., the parasite completes its development in a minimum of 12 days, the egg incubation period being 1 day, the larval period 7 days, and the pupal period 4 days. There are three larval instars, the first is very short. A minimum life-cycle of 10 days was reported by Cousin, at a temperature of 30° C., and of 16 days at 25° C. by Roubaud.

As a rule, males complete their development before females. Usually adults do not leave their hosts soon after emergence but remain within the puparia for a period varying from a few to 24 hours.

C. Diapause

Under certain conditions, full-grown larvae may rest in diapause, the duration of which is extremely variable and may continue for several years. Six full-grown larvae that underwent diapause were isolated in gelatin capsules (No. 0) and placed at 27.5° C. All died within a period of two to three months

D. Sexual dimorphism

Sexes are readily differentiated; males are micropterous, wings never reach the tip of the abdomen, females are macropterous, wings always reach beyond the tip of the abdomen. Apterous females have also been observed, but they are very rare. When mated with normal males, these females give rise to normal progeny (Cousin, 1933).

E. Reproductive organs

Both ovaries and testes are present in the earliest larval stage and look almost alike. Each consists of a pair of pyriform bodies on either side of the abdomen. Spermatogenesis and oogenesis do not set in, however, before pupation; the former process in the early pupal stage and the latter process

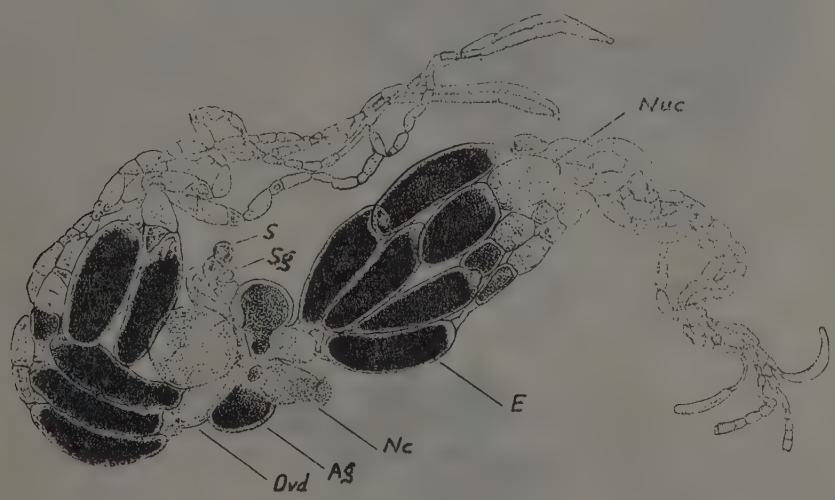


Fig. 1: Female reproductive organs of *Mormoniella vitripennis* (2 days old).

Ag. accessory gland; E. egg; Nc. nerve cord; Nuc. nutritive chamber; Ovd. oviduct; S. spermatheca; Sg. spermathecal gland.

late in that stage. Sperms were seen in the vesiculae seminalis of pupae 3 days old. Fully developed eggs, however, do not appear in ovaries of females before 24 hours after emergence.

The female reproductive organs in the adult consist of two ovaries of four ovarioles each (fig. 1). Cases of females having three ovariole ovaries, or having three ovarioles in one ovary and four in the other have also been observed (fig. 2). Oviducts are remarkably short, the two ducts unite to form the vagina. In the vagina open the two ducts of two double-bodied

accessory glands and the duct of the spermatheca. Connected to the distal part of the spermathecal duct are the spermatheca and its gland.

The male reproductive organs, in the adult (fig. 3), consist of two testes, each connected to a narrow duct, *vas deferens*. The *vesicula seminalis*

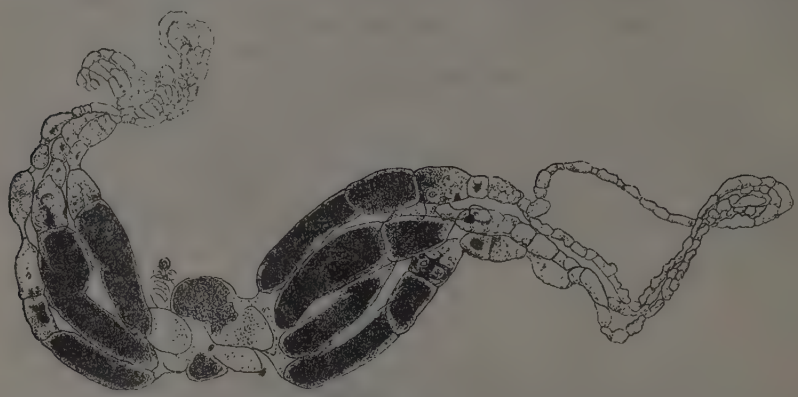


Fig. 2: Female reproductive organs of *Mormoniella vitripennis*, showing an unusual ovary formed of three ovarioles.

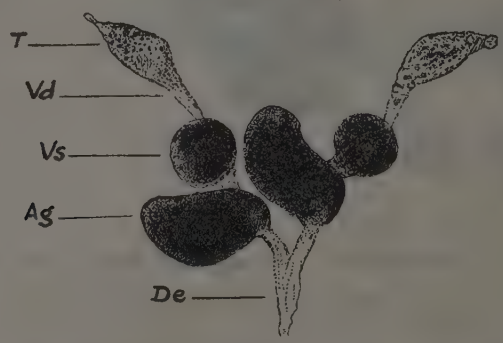


Fig. 3: Male reproductive organs of *Mormoniella vitripennis*, removed from a male 2 days old. Darkness of vesicula seminalis indicates abundance of sperms.

Ag. accessory gland; De. ductus ejaculatorus; T. testes; Vd. vas deferens; Vs. vesicula seminalis.

forms a swollen structure half way along the *vas deferens*. Into the distal part fo the latter, opens the duct of the accessory gland, which is comparatively large. The two *vasa deferentia* then unite to form the *ductus ejaculatorus*.

Sperms could be easily seen moving in the spermatheca of mated females and in the *vesiculae seminalis* of males, when dissected in physiological salt solution.

F. Mating

Mating takes place soon after the parasites leave their host puparia. Though the same puparium may contain both males and females, mating never takes place inside. This could be easily demonstrated by dissecting females spermathecae immediately after leaving their hosts, as well as by the fact that a female receiving a full complement of sperms does not accept males. This, however, does not mean that females mate only once. It often happens that, due to the scarcity of males, a single male may mate with five or six females within a few minutes. As a result of this, the fifth or sixth mating may not be effective in the sense that the fifth or sixth mated female may not receive enough sperms, and thus may mate again with the first male she meets. It happens also that if a female lives over a long period it may use up its supply of sperms and thus mates again to provide herself with a further supply. This, however, does not take place before several weeks of extensive egg deposition. It seems, from the foregoing, that the reflex controlling mating on the part of females appears to be the amount of sperms in its spermatheca (Cousin, 1933).

That mating has no effect on egg production is shown by the fact that mated as well as parthenogenetic females give approximately the same number of progeny, as will be shown later.

G. Fecundity

The reproductive capacity of *Mormoniella* is rather high. It depends on the nutrition of the parasite during its larval development, temperature and longevity of adults. The average number of progeny per female, using 39 *mated* females reared on *Musca domestica* at 27.5° C., was 95; using 35 *unmated* females, was 112. The average longevity of mated females was 13 days. A single female that lived 42 days gave rise to 685 individuals.

Cousin gives the following figures as representing the number of progeny of 9 females, which were reared and which oviposited at 18° to 22° C., and which fed exclusively on 2 host puparia of *Lucilia sericata* per day : 217, 279, 285, 342, 401, 474, 488, 526 and 557. Correspondingly the longevity of these 9 females were 17, 25, 24, 28, 33, 34, 35, 47 and 42 days. Two unmated females that lived 24 and 37 days gave 292 and 417 individuals. The average longevity at 18° to 20° C. varied from 20 to 25 days. The maximum at 18° to 22° C. was 51 days. These figures, for both longevity and reproduction, as reported by Cousin, are rather high. Roubaud re-

ported 46, 103 and 105 individuals per female from parasites reared on *Calliphora*. From 3 to 103 individuals per female are reported by Girault and Sanders from parasites reared on *Musca domestica*.

Eggs are rarely deposited singly; generally in batches of 5 to 13 eggs. Up to 62 eggs are deposited by a single female per day (Fukuda, 1939). The maximum number of progeny obtained from 1 female in a single day in the present work was 47. Cousin reports a maximum of 51 individuals. The maximum number of individuals that can complete their development in a single host also varies with the host. It is 90 in *Sturmia sericariae* and 53 in *Lucilia sericata*.

H. Sex ratio

Various authors have given figures for the sex ratio of *Mormoniella vitripennis*, varying from 1:1 to 10:1. In almost every case the parasite was reared under different conditions and on different hosts. The average sex ratio of the total progeny of 39 females reared on *Musca domestica* at 27.5° C., was found to be 4.8:1. A sex ratio of 1:1 to 2:1 is obtained, however, when the parasite is reared in mass, exposing 300 to 400 host pupae for 18 hours to approximately 200 female parasites. This low sex ratio is probably due to the effect of superparasitism and elimination of females.

EFFECT OF HOST FEEDING ON REPRODUCTION IN MORMONIELLA

Mormoniella stores large amounts of food material during its larval development, to meet the requirements of egg production. This stored food, however, does not seem to furnish the adults with enough material to complete their normal reproduction. Adults depend, at least to a certain extent, on host-feeding, a phenomenon that is said to occur in species representing about 25 families of parasitic Hymenoptera (Clausen, 1940).

The importance of host-feeding on nutrition and egg production of females of *Mormoniella* was emphasized by Roubaud (1917). He considered the process as a prerequisite for oviposition as well as necessary for the normal development of eggs in the ovaries.

Though host-feeding is essential before normal oviposition could take place, the short period of aproximately 1 hour intervening between the two processes (De Bach, unpublished notes) and the fact that ovaries of females that have no access to host material or even sugar solutions are seen packed with fully developed eggs 24 to 48 hours after emergence shows that host-feeding does not play an important role, if any, in the formation of eggs deposited soon thereafter. It may be interesting to note that three days are

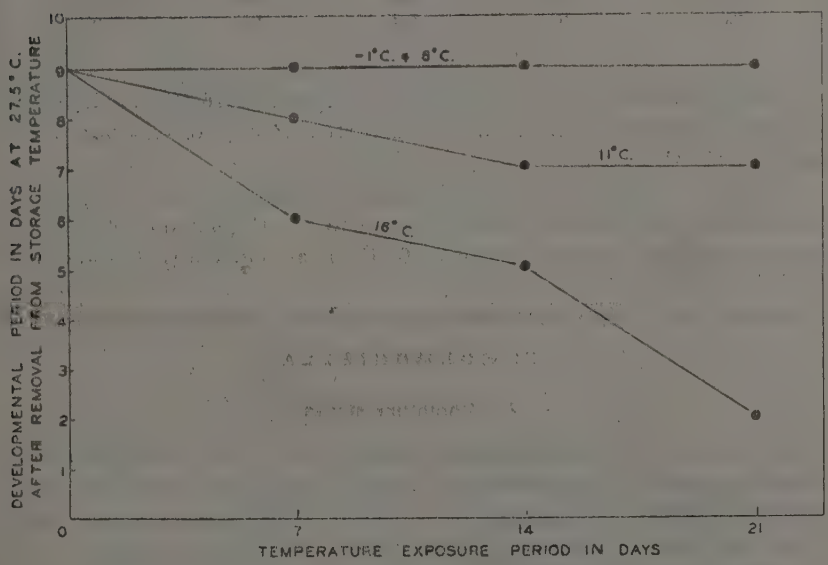
required for complete dvelopment of the eggs in the ovary of *Metaphycus helvolus* (Flanders, 1942).

Cousin observed that males may feed on the host body fluids exuding through the punctures made by females. Parker and Thompson have not seen males feeding even on sugar solutions in nature.

EFFECT OF LOW TEMPERATURES ON DEVELOPMENT IN MORMONIELLA

When immature stages of *Mormoniella vitripennis* are exposed to 6° C. or less, they do not show any signs of development ; even after 35 days'

GRAPH I



Effect on development of exposing parasites of *Mormoniella vitripennis* 3 days old to different temperatures and 100 per cent R.H.

Life cycle from egg to adult at 27.5° C. is 12 days.

Based on the study of 978 feeding larvae.

exposure. The time required by these parasites to complete their development after various periods of exposures to 6° C. is always equal, if not longer, than the time required had they not been exposed to these tem-

peratures. Immature stages of the parasite, on the other hand, continue to feed and develop successfully, at least temporarily, when stored at 11° C. or 16° C. (Graph I). Immature larvae, exposed when 1 to 2 days old, attain the full-grown larval stage after 10 days of storage at 16° C., and 21 days of storage at 11° C. Full grown larvae readily change into pupae at both temperatures. The amount of metamorphosis during the different periods of exposure to 11° C. is shown in the following Table.

TEMPERATURE EXPOSURE PERIOD IN DAYS	FULL GROWN LARVAE	PUPAE	TOTAL	TRANSFORMATION PERCENTAGE
7	54	153	207	73.9
14	46	163	209	78.0
21	9	118	127	92.9
28	10	131	141	92.9

When advanced pupae, 3 days old, are exposed to 16° C., adults emerge within 3 days. Only a few adults emerged after 14 days of exposure of such pupae to 11° C.

Housefly pupae 2 to 3 days old, however, hatch within 6 days of exposure to 16° C., and 21 days of exposure to 11° C., but do not show any signs of development when stored at 6° C. or at temperatures below 6° C.

EFFECT OF LOW TEMPERATURES ON THE RATE OF MORTALITY IN MORMONIELLA

A. Immature stages

A study of the rate of mortality of full grown larvae, newly formed and advanced pupae of *Mormoniella* and housefly pupae 2 to 3 days old, when exposed to temperatures ranging from —8° to 16° C. shows that in all cases, at all temperatures, there is a gradual increase of mortality that is correlated with the period of exposure.

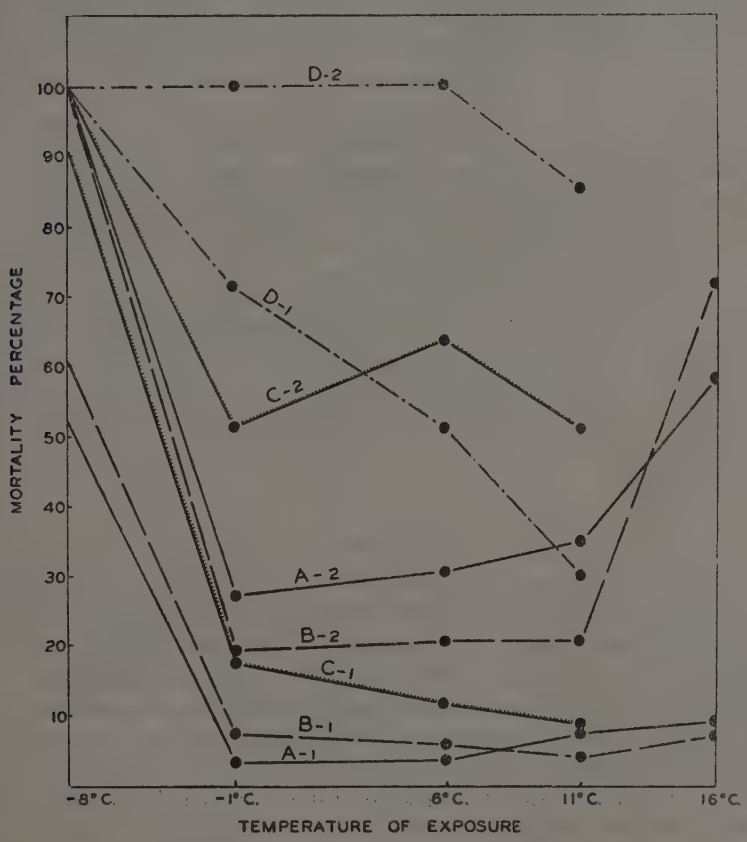
Graph II shows the comparative effect of low temperatures on the rate of mortality of the various stages of the parasite and its host after the first and third weeks of exposure. It is clear from this Graph that :

(1) The rate of mortality of the host is greater than any of the stages of the parasite at all temperatures from —8° to 11° C.

(2) The advanced pupal stage of the parasite shows a higher mortality than both the larval and newly formed pupal stages, there is not much significant difference between the latter two stages.

(3) The storage temperatures causing the lowest mortality range from —1° to 6° C. for the full-grown larval stage of the parasite, and from —1° C. to 11° C. for the newly formed parasite pupae. It is 11° C. for the advanced parasite pupae and housefly pupae.

GRAPH II



Effect of low temperatures on the mortality percentages of the parasite *Mormoniella vitripennis* and its host *Musca domestica* after 7 and after 21 days of exposure.

A-1, B-1, C-1 and D-1: 7 days exposure; A-2, B-2, C-2 and D-2: 21 days exposure; A-1 and A-2: Full-grown parasite larvae; B-1 and B-2: Newly-formed parasite pupae; C-1 and C-2: Advanced parasite pupae; D-1 and D-2: Host pupae.

Based on the study of 1256 parasite larvae, 4998 parasite pupae and 1598 host pupae.

We may then conclude that the optimum storage temperature of full-grown larvae and pupae of the parasite is lower than that of the host, and that of the full-grown larvae and newly formed pupae is lower than that of the advanced pupae of the parasite.

Ullyett (1935), in comparing the effect of low temperatures on *Apanteles sesamiae* and its host, the maize stalk borer *Busseola fusca*, concluded that the threshold of development of the former is lower than that of the latter. Flanders (1938) observed that, while the eggs of the elm leaf beetle did not survive when shipped for 14 days at temperature of 38° F., there was little, if any, mortality among the various stages of its egg parasite (*Tetrastichus* sp.).

Van Steenburgh (1934) observed that both eggs and developing larvae of *Trichogramma* showed increasing mortality with longer periods of exposure at 30° to 32° F. Less mortality was obtained when the parasite was stored after reaching the pupal stage. Temperatures ranging between 35° to 45° F. still gave lower mortality.

Meier (1938) found that when *Trichogramma evanescens* was exposed as full grown larvae, within the eggs of *Sitotroga cerealella*, to a temperature varying from 1° to 2° C. for 1, 2, 3, and 4 months, the mortality percentages were respectively 7.8, 33.9, 48.1 and 48. When the parasite was exposed as pupae, however, the percentages of mortality were 39.9, 55, 68 and 85. It is clear that in this case the full grown larvae are more resistant to cold than are pupae.

B. Adults

The effect of exposing adults of *Mormoniella* to —8° C. is rather interesting. Eighty-five mated females 2 days old were exposed for 3 days to —8° C. On being removed, none of them showed any signs of life and it was thought that they were all dead. However, after being placed at a temperature of 27.5° C. in the laboratory for 45 minutes, a few of them began to move their antennae and legs and within a few hours 25 recovered completely and were able to feed and deposit eggs when provided with host puparia. The experiment was repeated, using 218 females. After 3 days' exposure, only 55 females recovered, with a mortality percentage of 74.8 Thirty of the survivors were allowed to feed on honey for 3 hours before being replaced in storage. After two more days exposure only 12 of them recovered.

C. Theories of cold hardiness in insects

That insects can withstand temperatures well below freezing is a well established fact. The actual temperatures which the tissues can withstand

vary with the species. The various theories concerning cold hardiness in insects are of interest.

Reaumur (Uvarov, 1931) suggested that in an insect apparently completely frozen there yet remain some fluids which freeze at a much lower temperature and that death occurs only when all fluids are frozen.

Bachmetjew (Uvarov, 1931) propounded the theory of anabiosis or the maintenance of the structure of the organism without life processes. He established the possibility of complete freezing of the water within an organism without lethal effect.

Robinson (1927) proved that freezing causes death in most of the insects he studied and developed a theory based on hygrophilic colloids and their importance in cold-resistance of insects.

All the aforementioned theories tend to explain cold-hardiness in insects on the purely physical relationship of water and protoplasmic colloids.

Kozhantshikov (1938) advances a theory based on the nature of cellular respiration at low temperatures and its relation to the structural elements of the cell. This theory postulates that in non-hardy species and in developing phases of hardy ones, development of which cannot be stopped without lethal effect by unfavorable conditions, the cellular respiration is caused by oxydases that act in connection with the structural elements of cells. The resistance to temperatures below zero is observed only during supercooling of the protoplasmic water, not when it freezes. The destruction of cellular structures by the crystallization of the water causes the cessation of respiration and the death of the organism. In cold-hardy insects, in certain of their stages which can be stopped in their development by the action of unfavorable conditions, or which exhibit the phenomenon of diapause, the cellular respiration is partly or completely carried on by dehydrase. This type of cellular respiration does not depend on the structural elements of the cells, but is connected with the chemical compounds of the protoplasm. Freezing of the protoplasmic water and the destroying of cellular structures do not affect the respiration caused by the action of dehydrases, and the phenomenon is of no importance in the survival of the organism.

Wigglesworth (1939) classifies insects into three groups, according to their resistance to cold :

(1) Those which die even above temperatures well above freezing point. The cause of death is often attributed to the accumulation of toxic products which at normal temperatures would be eliminated.

(2) Those which are killed as soon as their tissues freeze. The cause of death is often attributed to dehydration of the tissues, sometimes to mechanical injury by ice crystals.

(3) Few insects can withstand complete freezing, but die from unknown cause when the temperature is lowered still further.

He considers cold-hardiness in insects as chiefly a matter of prevention of freezing. When the temperature is lowered, water is supercooled and ice is not formed until the temperature has fallen far below the tissue-freezing point.

EFFECT OF LOW TEMPERATURE ON REPRODUCTION

A. Effect of unequal periods of exposure and equal temperatures.

When the parasite is exposed in the full grown larval stage newly formed pupal, advanced pupal, or in the adult stage, to any temperature between —8° to 16° C., for increasing periods, there is a gradual decrease of the reproductive capacity of females. That decrease is rather more abrupt than gradual at —8° C.

B. Effect of varying temperatures at fixed periods of exposure

That *rate* of decrease in reproductive capacity is greater as the temperature to which the parasites are exposed increases; within a range of —1° to 16° C. when the parasites are exposed in the full-grown larval or pupal stages (Graph III) and within a range of 6° to 16° C. when they are exposed in the adult stage (Graph IV). In other words, within these ranges, *for equal periods of exposure*, there is more progeny par female when the parasite is exposed to lower than to higher temperatures. Below these ranges, however, the number of progeny per female decreases with the decrease of temperature.

C. Effect on reproduction of exposure of feeding larvae to low temperatures

It is rather interesting to find out that there was a gradual increase in the number of progeny per female when exposed as feeding larvae to temperatures of 6° or 11° C. for increasing periods. This was correlated with increasing mortality among such feeding larvae. When exposed during the feeding larval stage to 6° C. for 7, 14 and 21 days the average number of progeny per female was 114. 132 and 143 respectively. When exposed to 11° C. the averages were 113, 101 and 163 respectively.

Apparently the increase in the amount of food made available for the survivors after the death of the other parasites on the same host pupae, and the consequent increase in amounts of stored foodstuff in the surviving larvae account for the increase in fecundity.

D. Effect on reproduction of temporary starvation of adults

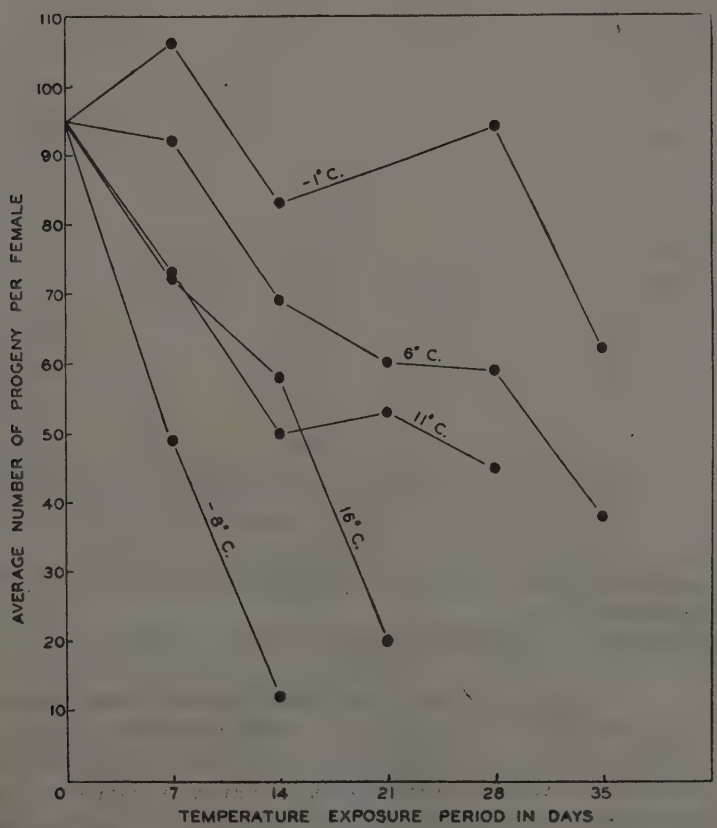
It is also interesting to notice that adult females stored at 6° or 11° C. for increasing periods, and removed every 3 days for 2 hours of normal res-

piration but allowed no food, showed a more rapid decrease in their reproduction (Graph V) than females that were allowed to feed on honey for the 2 hours.

E. Correlation between fecundity (power of producing eggs) and the number of progeny per female

It is interesting to point out that the decrease in the number of progeny per female is correlated under certain conditions with a decrease in the

GRAPH III

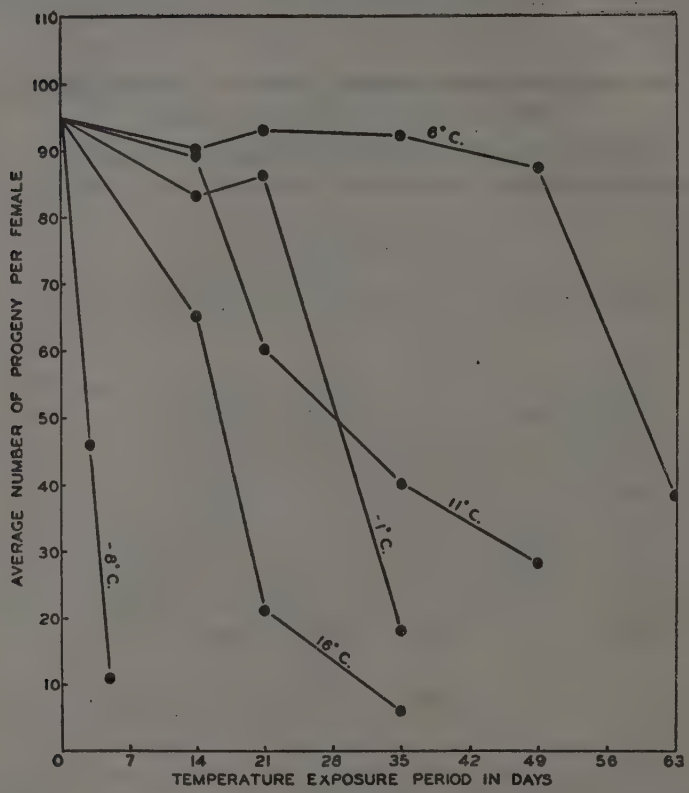


Effect on reproduction of exposing full-grown larvae of *Mormoniella vitripennis* to different temperatures and 100 per cent R. H.

Based on the study of the progeny of 428 females, numbering 21,111 individuals.

The average number of progeny per female reared from egg to adult at 27.5° C. is 95.

GRAPH IV

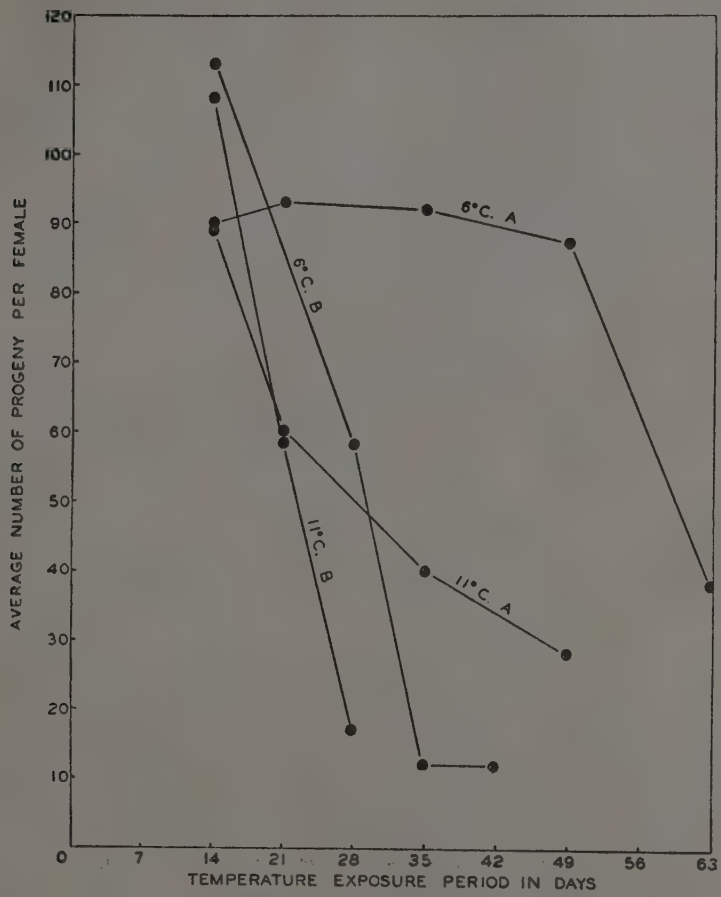


Effect on reproduction of exposing adult mated females of *Mormoniella vitripennis* to different temperatures and 100 per cent R. H. Females fed on honey for 2 hours every 3 days during their exposure period.

Based on the study of the progeny of 388 females, numbering 19.260 individuals.

number of eggs being deposited. Four females after 72 days exposure to 6° C. laid an average of 11 eggs each; the average number of progeny per female after 63 days' exposure to 6° C. is 38. Five females exposed to —1° C. for 42 days gave an average of 10 eggs each; the average number of progeny per female after 35 days' exposure to —1° C. is 18. Four females kept at —8° C. for 5 days deposited an average of 15 eggs each; the average number of progeny per female, for this period of exposure is 11. The normal average number of progeny per female is 95.

GRAPH V



Effect on reproduction of exposing adult mated females of *Mormoniella vitripennis* to 6° and 11° C. and 100 per cent R. H.: A. Adults placed in the laboratory every 3 days for 2 hours for normal respidation and feeding of honey; B. Adults placed in the laboratory every 3 days for 2 hours for normal respiration but allowed no food.

Based on the study of the progeny of 310 females, numbering 18.908 individuals.

F. Discussion

Van Steenburgh (1934) observed that the emerging females of *Trichogramma* laid only half as many eggs as those allowed to develop normally, when exposed as pupae to a temperature ranging from 35° to 45° F. for 75 days.

Hanna (1935) showed that the average number of eggs laid by females of *Euchalcidia caryobori* exposed as pupae to a temperature of 16° C. for 10, 25 and 40 days were 81, 6 and 2 eggs per female, respectively; the average normal was 102. In other words, there was a gradual decrease in the number of eggs laid and that was again correlated with the period of exposure.

Mormoniella stores up enough food material during its larval development to meet the requirements of egg production. Unlike many other Pteromalids, fecundity of females depends only to a very limited extent on host-feeding. Fat cells are present in greatest amounts in the mature larvae. The fat body, which normally occupies a good part of the abdominal cavity in the newly-emerged female, shows a gradual depletion as the process of oogenesis continues. It is undoubtedly at the expense of the fat body that the ovaries of adults grow so large.

Insects are cold-blooded (poikilothermic), and therefore their metabolism and activity are greatly influenced by their body temperature, which normally follows pretty closely that of the surrounding environment. Each insect species has a wide range of temperature between cold stupor and heat stupor. Within the limits of this vital zone, the organism is able to carry on its normal functions, its metabolism is accelerated by high temperatures and retarded by low. Toward the limits of this range, growth, reproduction or some other function may be adversely affected (Wigglesworth, 1939). It follows that in parasites stored at low temperatures, metabolism proceeds at a comparatively slower rate; but if storage period is prolonged, sufficient amounts of the stored products are used up and reproduction may be seriously affected. It follows also that metabolism proceeds at a higher rate when the insect is stored at higher temperatures than when it is stored at lower temperatures. Within equal periods of exposure, then, more stored foodstuff is used up in the first case than in the second and, consequently, less material will be available to meet the requirements of egg production when the parasite is stored at higher than at lower temperatures; and the amount of stored foodstuff available will be less with the increase in the period of exposure. Flanders (1938) observed that fat cells were less abundant in adult specimens of *Tetrastichus* sp., which were stored during their pupal stage for 2 weeks in the refrigerator, than in the unrefrigerated ones.

The foregoing discussion may explain, then, the gradual decrease of fecundity of females of *Mormoniella* with the increase of storage period, and the increase of fecundity with decrease in temperatures when stored for equal periods. It fails to explain, however, why adult females stored at —1° and —8° C. should have a lower fecundity than those stored at 6° C., and why storage during the full-grown larval stage to —8° C. should cause a greater decrease in fecundity than storage at —1° C. This may be

easily understood, however, when we consider that temperature does not only affect the gonads indirectly but it may have also a direct effect especially when extreme temperatures are used. Sikora (Uvarov, 1931) observed that in *Pediculus vestimenti*, a cooling to 16° C. for 2 hours was sufficient to reduce the number of eggs laid. *Pediculus* has a comparatively high temperature limit. Parker (1935) noticed that the fecundity and not the fertility of *Tribolium confusum* was adversely affected when the temperature rose from 28° C. to 39° C. in a period of 5 hours while the beetles were in the immature larval stage. Oosthuizen (1935) showed that exposure of adult *Tribolium* to heat for a few hours reduced the egg production during and after the exposure : « A reduced percentage of fertile eggs laid during and just after exposure, with a recovery in time, suggests a destruction of the matured egg cells, primary and secondary oocytes, while the oogonia are affected adversely but little. It is extremely difficult to determine to what extent this injury occurs in the ovarian tubules ».

It has also been shown by Young and Plough (1926) that exposure of adult males of *Drosophila* to a temperature of 31° C. for 10 days or more produces sterility from which a certain number do not recover when they are placed at 24° C. : « If only the spermatozoa are affected it is hard to see why this should happen. The data showing the recovery of the male flies suggests a progressive sterilizing effect beginning with the sperms and eventually reaching cells at earlier stages. Only when the latter occurred would the male fail to recover fertility when placed at 24° C. ».

G. Effect of low temperatures on the ovaries of Mormoniella

It is generally difficult to correlate the decrease in fecundity of females of *Mormoniellla* with any noticeable differences in their ovaries from the normal ovaries. Ovarioles of adult females stored at 16° C. for 14 days but allowed no food, however, contain few, if any, fully developed eggs in their ovaries at any time during their life after being placed at 27.5° C. The disappearance of mature eggs from these ovarioles is due to the disintegration of the ovarian follicles and the eggs and their consequent absorption. « When environmental conditions inhibit oviposition, the ovarian follicles and the eggs apparently disintegrate and are absorbd... » (Flanders, 1935). Ovaries of females stored at 16° C. for 21 days or at —8° C. for 14 days, in their full-grown larval stage, show various degrees of deviation from the normal. While in the majority of females they look exactly like the normal ovaries under the microscope, in a few females the eight ovarian tubes are shrunken into very short tubules, or contain small nutritive chambers alternating with immature eggs. In few others only one or more ovarioles are adversely affected. Similar observations were made by Hanna (1935).

Young and Plough (1926), however, failed to discover any difference in the cytological picture between normal ovaries of *Drosophila* and ovaries of females from sterile cultures, except that the latter appeared smaller.

ORIGIN OF FEMALES FROM UNFERTILIZED EGGS OF MORMONIELLA VITRIPENNIS (WALKER)

Although the production of males in uniparental (1) species of hymenoptera is a relatively common phenomenon, reports of the production of females by unmated females of biparental (2) species are looked upon with suspicion.

The production of females from unmated females of biparental species, however, has been reported by various workers in different species of Hymenoptera of different families.

Balch et al (1941) noticed the development of a female from an unfertilized egg in the biparental type of the European spruce sawfly, *Gilpinia polytoma* (Tenthredinoidea, Diprionidae). They considered that this record, however, must be due to some mistake.

Rosenberg (1934) reports that in *Ephialtes extensor* (Ichneumonoidea. Ichneumonidae) from one parthenogenetic egg a female was reared.

Webster (1909) claims the production of females from parthenogenetic females of *Lysiphlebus tritici* (Ichneumonoidea, Braconidae). He was able to breed a limited number of females parthenogenetically to and including the third generation. In *Habrobracon brevicornis* (Ichneumoniodea, Braconidae) Hase (1922) was able to get females from unfertilized eggs.

The occurrence of impaternate females in *Habrobracon juglandis* (Ichneumonoidea. Braconidae) has been reported by Whiting (1924) and Speicher (1934).

Alder (Howard, 1891) showed that non-fecundated females of *Pteromalus puparum* (Chalcidoidea, Pteromalidae) produce females.

Tanner (Wheeler, 1928) claimed that workers of the large leaf-cutting ant, *Atta cephalotes* (Formicoidea, Formicidae) produced male workers and queens.

Richenbach (Wheeler, 1928), Mrs. A.B. Comstock (Wheeler, 1903), and Crawley (1912) claim to have reared workers from the unfertilized eggs of *Lasius niger* workers (Formicidae).

Box (1925) obtained female progeny in two instances from unfertilized parents in *Campsomeris trifasciata* (Vespoidea, Scoliidae).

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(1) A uniparental species is one where females are produced generation after generation from unfertilized eggs; unisexual species of other authors (after Flanders).

(2) A biparental species is one where females are produced from fertilized eggs; bisexual species of other authors (after Flanders).

Onion (1912 and 1914) and Jack (1917) claim that the workers of the South Africa race of *Apis mellifica* [var. *kaffra* or *intermissa*] (Apoidea. Apidae) produce parthenogenetically males, workers and queens.

Hewitt (Anderson, 1918) working on Tunisian bees imported from North Africa to England reported that when a colony of these bees becomes queenless, laying workers will develop promptly and queens, workers and drones will be reared from the eggs produced by them. These parthenogenetic females do not occur in the native bee there (Hewitt, 1892).

Mackenson ((1943) reported that parthenogenetic females were found to occur in three strains of bees (the Caucasian, the three banded Italian and the golden Italian strains). The number produced by any one queen was estimated not to exceed one per cent. Both workers and queens produced parthenogenetically appeared to be normal diploid individuals. He concludes that the available data indicate that this characteristic is more widespread than has been commonly believed and suggest that the many queens that have been reported to appear unexpectedly in hopelessly queenless colonies can best be explained as having arisen from eggs laid by laying workers.

While studying the effect of low temperatures on the sex ratio of *Mormoniella vitripennis* (Walk.) it was suggested to me by Flanders that the rearing of *Mormoniella* at low temperatures would affect the sex of the progeny of unmated females. In *Habrolepis rouxi*, a uniparental species which parasitizes the red scale, *Aonidiella auratii*, he was able to get females which produced males exclusively. Under optimum conditions of development *Habrolepis rouxi* females produced only females. The male-producing females were exposed to high temperature during the gg or early larval period. It was thought that unmated females of biparental species, which usually produce males only, might produce some females, if exposed during their larval development to low tempratures. With this in mind, a series of tests was devised, whereby *Mormoniella* larvae 1 to 2 days old were stored at the following temperatures : 27.5, 20, 16, and 11° C. In the first three experiments parasites were allowed to complete their development at the temperature of exposure Parasites exposed to 11°C. were removed after 21 days and placed at the laboratory at 27.5° C. to complete their development.

In all cases, pupae of the parasites were placed singly in number O gelatin capsules, so that emerging females would not have any contact with any males. On emergence, each female was transferred to an oviposition tube, provided with honey, placed in the laboratory at 27.5° C. and supplied with three 2-3 days old host puparia every day. Every precaution was taken to make sure that the host material had not any contact with any parasites before or after being provided to any of these unmated females.

In all these experiments approximately 155 unmated females were used,

giving a total number of progeny of 15.935 individuals. Only 3 of these individuals were females. These 3 were produced by a single unmated female, reared from egg to adult at 27.5° C., on its third day of oviposition. Fortunately, the parent was still alive and dissection showed that its spermatheca was devoid of sperms. Dissection of the ovaries of the progeny revealed that they were normal in every respect.

The following hypotheses are put forward by Speicher and Speicher (1938), to provide a possible explanation for the production of diploid females from unmated females.

(1) One of the two maturation divisions of an unfertilized egg could be suppressed, as was observed by Silvestri (1908) in the wasp *Prospaltella*. This would leave a cleavage nucleus containing the diploid number of chromatids which would restore the diploid number of chromosomes if the homologues separated.

(2) Fusion of two reduced egg nuclei present in a binucleate egg also would restore the diploid condition.

(3) The doubling of chromosomes in the haploid egg during cleavage.

(4) In *Habrobracon*, Speicher and Speicher (1938) present cytological evidence to show that the impaternate females result from unfertilized eggs which are tetraploid before reduction and diploid after reduction.

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Notes on the Biology and Feeding Habits of the introduced beneficial insect *Leis conformis* Boisd.

[Coleoptera : Coccinellidae]

(with 1 Figure, 1 Graph, and 5 Tables)

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INTRODUCTION

In 1934 during a visit to our parasites laboratory at Giza by Dr. A. L. Tonnoir, the late research officer at Canberra, a plan for the introduction of beneficial insects into Egypt was discussed. This discussion has culminated in the initial attempt to import the coccid and aphid feeding labybird beetle *Leis conformis* which is considered an eclectic feeder abounding in large numbers in the vicinity of Canberra.

Through the courtesy of the Australian Council for Scientific and Industrial Research, three consignements, totalling 250 insects were received in the fall and early winter of 1936; only five insects survived the trip only to die at our laboratory a few days later. In the fall of 1937 two more consignments, totalling 200 insects, were again received and only six adults, 3 ♀♀ and 3 ♂♂, arrived alive in the second consignment of 100 pupae.

The insects were dispatched by air mail in the form of adults and pupae; many of the latter emerged en route and few adults laid a number of eggs which hatched into larvae. The journey took from 15-17 days. Mortality in the five consignments reached as high as 98%. In most cases death, in all probability was due to the lack of adequate food for the adults during their journey and to excessive heat during the trip over the Malayian Peninsula.

From this small stock of six insects, however, a total of 586 adults and larvae were reared in the laboratory and liberated in the vicinity of Cairo-Agouza, Dokki, Giza, El Kanater, and Alexandria. Liberations were made

at Agouza on 10.2.1938 and 17.3.1938. One egg mass of 15 eggs was recovered from this locality on 22.2.1938. Another egg mass and few adults were again recovered from the same locality on 22.3.1938, 18.4.1938 and 26.4.1938. No further recoveries have since been made.

This beetle was introduced earlier into Florida, where it became established, to combat *Aphis spiraecola*.

Biology

Before we proceed to give a brief account of the biology of the beetle, we would like to admit that the available data are not conclusive enough to warrant decisive conclusions particularly from the ecological view point, but we hope that they elucidate some important phases of the biology and habits of this beneficial labybird beetle.

Fig. 1. — *Leis conformis* Boisd., adult (enlarged).

The adult insect (fig. 1) is comparatively a big coccinellid, the average length of female being 6.2 mm. while the average width is 5.4 mm.; the male is 5.8 mm. and 5.0 mm. respectively. Dorsally the prothorax and elytra are orange yellow, but as the insect gets older this colour changes into brownish yellow. The prothorax is dotted with 4 black spots. More often than not the two spots on each side fuse together to form one compound spot. There are still another 18 black spots on the two elytrae as well as a very small pale brownish spot located in the middle of the posterior region of the prothorax.

Reproduction and parthenogenesis

Both mated and unmated females will begin laying eggs several days after emergence. In five mated females oviposition began 14, 14, 14, 21 and 15 days successively after emergence, that is an average of 15.6 days after emergence. In five other unmated females egg laying began 19, 15, 25, 9 and 11 days successively after emergence, that is an average of 15.8 days after emergence.

Eggs are laid in clusters varying from 1-50 eggs each. Very often the eggs of each cluster are arranged in one layer and very rarely in two layers one above the other. The eggs are laid on ends with sides contigious. In oviposition experiments egg masses were laid more often on both surfaces of citrus leaves and less often on duranta leaves and the inner walls of Mason jars used for breeding. The female takes from 1-3.5 minutes to lay one egg.

Unmated females will lay very few eggs singly or in very small clusters. The total number laid by five unmated females was correspondingly 2, 6, 8, 17 and 9 with a total average of 8 eggs per female.

Mated females lay a larger number of eggs as represented in the following figures deposited by five successive females, 466, 149, 498, 42 and 349 with an average of 301 eggs per female. Thompson (1926) reporting on the same species states that one mated female has laid a total of 904 eggs; a figure much higher than any reported in this work. Change in food or diet as well as other physical factors of the environment may account for this difference. It has been shown by many workers that several factors including seasonal temperature and quantity of food, affect the amount of oviposition. Bodenheimer (1932) has found that the average number of eggs laid by female of *Rodolia cardinalis* in Palestine during winter, spring, summer and autumn was 198, 320, 335, and 272 respectively and that the daily rate gradually increased up to 28° C. In *Hippodamia tredecimpunctata*, Cutright (1924) has shown that when an adult was given 5-10 aphids daily, neither mating nor oviposition took place, but eggs were produced at a maximum rate when 50 or more aphids were supplied each day.

That mated females will lay more eggs than unmated ones seems to be the case in many other insects. It was found by King and Slifer (1934) that unmated females of Acridiids produce notably less eggs than mated females, the same applies to *Musca* (Glazer, 1923). It has also been shown that though unmated females of Lepidoptera develop the same number of ripe eggs as mated females, they lay only about one third of their total store (Eidmann, 1929 and 1931). Whether the marked reduction in the number of eggs laid by unmated females of *L. conformis* is through the effect of the lack of impregnation on egg production or on oviposition, we are not in a position to discuss just right now. It is of interest, however, to deduce that

Table I

Egg incubation period, duration of larval and pupal stages of *Leis conformis* Boisd. at 23° C.

INSECT NUMBER	OVIPOSITION	HATCHING	INCUBATION PERIOD	FIRST MOULT	DURATION OF FIRST INSTAR	SECOND MOULT	DURATION OF SECOND INSTAR	THIRD MOULT	DURATION OF THIRD INSTAR	PUPATION	DURATION OF FOURTH INSTAR	EMERGENCE	DURATION OF PUPAL STAGE
1	3.3.1938	7.3.1938	4 days	10.3.1938	3 days	14.3.1938	4 days	18.3.1938	4 days	24.3.1938	6 days	30.3.1938	6 days
2	"	"	"	"	"	13.3.1938	3 "	17.3.1938	"	"	7 "	"	"
3	"	"	"	"	"	14.3.1938	4 "	18.3.1938	"	"	6 "	"	"
4	"	"	"	"	"	13.3.1938	3 "	17.3.1938	"	23.3.1938	6 "	29.3.1938	"
5	"	"	"	"	"	"	3 "	18.3.1938	5 days	26.3.1938	8 "	1.4.1938	"
6	"	"	"	"	"	14.3.1938	4 "	"	4 days	24.3.1938	6 "	30.3.1938	"
7	"	"	"	"	"	13.3.1938	3 "	17.3.1938	"	23.3.1938	6 "	29.3.1938	"
MEAN			4 days	—	3 days	—	3.75 days	—	4.14 days	—	6.42 days	—	6 days

Total cycle from egg to adult at 23° C. varies from 26 to 27 days

the presence of the sperms in the spermatheca of females has a definite effect one way or the other. At any rate, eggs laid by unmated females fail to hatch and soon collapse.

In the early days of oviposition of mated females egg laying is more frequent and the clusters are rather big; up to 60 eggs may be laid by one female in one day. As the insect gets older the clusters get smaller and oviposition becomes less frequent, until several days before death ensues, the insect ceases completely to lay any eggs.

In an experiment five females were kept alive for 98, 97, 96, 95 and 69 days successively, the records of oviposition in days ran as high as 31, 28, 46, 17 and 28 respectively and the corresponding number of egg clusters ranged as follows 47, 31, 63, 22 and 32.

Larval development

Newly laid eggs are yellowish opaque more or less spindle shaped, narrow at the base and broad at the top. Each is about 1.7 mm. long, 0.3 mm. wide. As the embryo develops, the colour changes into reddish and a few hours before the larva hatches, the colour of the egg turns into grey and darker as the last of the yolk is consumed. The egg incubation period was found

TABLE II

EXPERIMENT NUMBER	DATE OF OVIPOSITION	DATE OF ADULT EMERGENCE	CYCLE FROM EGG TO ADULT	MEAN TEMPERATURE IN °C.
1	15.12.1937	15.1.1938	31 days	22
2	26. 1.1938	28.2.1938	33 „	22 (*)
3	11. 3.1938	6.4.1938	26 „	23
4	16. 4.1938	8.5.1938	23 „	25.5
5	25. 5.1938	18.6.1938	24 „	27.3

(*) In this experiment temperature fell much below normal on the last two days of development (27th and 28th February).

to last 4 days at an average temperature of 23° C. The larva makes its way through one corner at the upper cephalic end of the egg leaving the chorion as a whitish opaque sac.

The newly emerged larva is 2 mm. long and 0.3 mm. wide, dark at the dorsal surface and brown ventrally. The young larvae crawl actively, searching for their prey.

There are four larval instars, the average durations of these stages at 23° C. were 3, 3.75, 4.14 and 6.42 days respectively. The pupal period took an average of 6 days. In the duration tests each larva was put separately in a tube 10 cms. long and 3 cms. wide, covered with muslin and provided daily with host insects. Observations were made every morning and the moulted skin was always credited to the day on which it was removed.

Table I represents the egg incubation period, duration of the larval and pupal stages for 7 insects at 23° C.

Temperature versus growth

Table II shows the effect of temperature on growth. Cycle represents the shortest period obtained at the particular temperature.

This Table shows a gradual increase in the rate of growth with rise of temperature up to 25.5° C. At 27.3° C., however, the rate of development is less than at 25.5° C. This shows that the optimum temperature for growth of *Leis conformis* lies between 25.5° C. and 27.3° C.

Longevity of Adults

It has been found that females live a little longer than males and that longevity of insects differs according to the season. Eight adults emerging early in February lived for 92, 94, 60, 69, 95, 96 and 97 days respectively with a mean of 87 days. 19 insects emerging between the middle of March and early April lived for 23, 43, 43, 46, 50, 74, 68, 47, 44, 34, 44, 70, 51, 75, 37, 34, 43, 71, and 73 days respectively with a mean of 51 days.

Adults kept in captivity without food lived up to 6 days at a temperature of 23° C.

Dormancy

Thompson (1926) states that *Leis conformis* tended to congregate in the mild winters of Florida. It also clustered in a dormant state in the warmer days of May and June, suspending both its feeding and reproductive activities.

Host specificity and feeding habits

The beetle is rather polyphagous, it feeds on a wide range of host insects. *Aphis pseudobrassicae*, *A. durantae*, *A. citri*, *A. nerii*, *Chrysomphalus ficus* and *Pseudococcus sacchari* are among insects devoured by the beetle in the laboratory. The insect, however, seems incapable of completing its development on many of these hosts.

Though both larvae and adults are essentially carnivorous, Watson and Thompson (1933) have noticed that large numbers of the adults fed on extra floral nectaries at the base of the flowers of *Crotalaria striata*, on pollen of sow palmethes, the tender terminal buds of scrub oak, sap issuing from pruning wounds on tangerine trees and the blossoms of fire weed (*Erechtiles*) including the pistils and stamens.

The ability of this insect to derive nourishment from both living plants and animals is an obvious advantage. Forbes (1883) states that if such insects can live on soft parts of plants when their animal food becomes scarce, their numbers will be maintained at a far higher figure than would be possible when depending on animal food alone. As a consequence they will be prepared to concentrate a powerful attack upon any group of food insects which may become suddenly abundant.

Cannibalism

Various forms of cannibalism are noticed in this beetle. Adults feed on their eggs and suck the body fluid of the larvae leaving the outer integument of the body, legs and head. In one instance an adult beetle fed on 8 newly laid eggs at one meal. It takes the insect from 40-50 seconds to devour one egg while five seconds are needed to feed on a medium sized aphid such as *Aphis durantae*, even the solid parts of the prey including wings and appendages are swallowed by the ladybird.

Larvae of the beetle were also seen feeding on younger larvae as well as eggs.

Feeding Capacity of Immature stages

The feeding capacity of the insect in its various stages of development was carefully studied. In the individual feeding tests each larva was kept separate in a vial 10 cms. long and 3 cms. wide, covered with cheese cloth or muslin and provided daily with sufficient number of two thirds grown aphids of *Aphis durantae* in order to get the optimum feeding conditions. This size of the host was found easier to observe and to give a more accurate measure than other sizes.

Observations were made every morning at the same time and the number of aphids left in each vial was substracted from the original number provided the day before thus giving the correct number consumed per day. There was almost no natural mortality among the aphids since only healthy and selected individuals were used.

The amount of food consumed at 23° C. by one larva throughout the larval period varied from 318 to 441 with a mean of 388 two thirds grown individuals of *Aphis durantae*. The feeding period varied from 16 to 19 days

with an average of 17 days and the daily mean of aphid consumption throughout the larval period varied from 20 to 26 with an average of 23 as shown on Table III.

Table III

Consumption of two-thirds grown *Aphis durantae* by *Leis conformis* larvae at 23° C.

DATE	APHIDS EATEN BY LARVA NUMBER 1	APHIDS EATEN BY LARVA NUMBER 2	APHIDS EATEN BY LARVA NUMBER 3	APHIDS EATEN BY LARVA NUMBER 4	APHIDS EATEN BY LARVA NUMBER 5	APHIDS EATEN BY LARVA NUMBER 6	APHIDS EATEN BY LARVA NUMBER 7
7.3.1938	14	10	11	7	1	1	7
8. "	5	8	11	6	6	11	7
9. "	0	4	4	4	6	3	2
10. "	7	8	12	4	13	9	2
11. "	15	11	12	5	8	7	10
12. "	5	5	0	2	8	7	0
13. "	14	20	15	17	18	11	19
14. "	15	30	15	28	30	14	27
15. "	22	5	30	2	11	30	7
16. "	2	23	18	20	0	28	12
17. "	28	30	14	28	5	13	30
18. "	21	40	25	36	0	18	33
19. "	50	50	48	50	26	45	44
20. "	70	60	58	69	47	14	55
21. "	99	54	95	34	63	120	58
22. "	46	56	73	6	82	102	8
23. "	0	0	0	pupated	23	0	pupated
24. "	pupated	pupated	pupated		26	pupated	
25. "					6		
26. "					pupated		
TOTALS	413	414	441	318	379	433	321
FEEDING DAYS	17	17	17	16	19	17	16
DAILY MEAN OF APHID CONSUMPTION	24	24	26	20	20	25	20

It was also found that the amount of food consumed by each larval instar was greater than the amount consumed by the preceding instar as seen in Table IV.

Table IV

Amount of food consumed by each larval instar at 23° C.
(Based on data from Table III)

INSTAR	APHIDS EATEN BY LARVA NUMBER 1	APHIDS EATEN BY LARVA NUMBER 2	APHIDS EATEN BY LARVA NUMBER 3	APHIDS EATEN BY LARVA NUMBER 4	APHIDS EATEN BY LARVA NUMBER 5	APHIDS EATEN BY LARVA NUMBER 6	APHIDS EATEN BY LARVA NUMBER 7	MEAN
1st	19	22	26	17	13	15	18	19
2nd	41	24	39	11	29	34	10	27
3rd	67	78	77	67	64	85	65	72
4th	286	290	299	223	273	299	228	271

The above data indicate plainly that the amount of food consumed by the third larval instar is twice the amount consumed by both the first and second instars while the amount of food consumed by the fourth instar is 2.3 times the amount consumed by the previous three instars.

This is partly due to the fact that each stage is longer than the one preceding it (see Table I) and in part to the fact that the rate of food consumption increases at successive instars as shown in Table V.

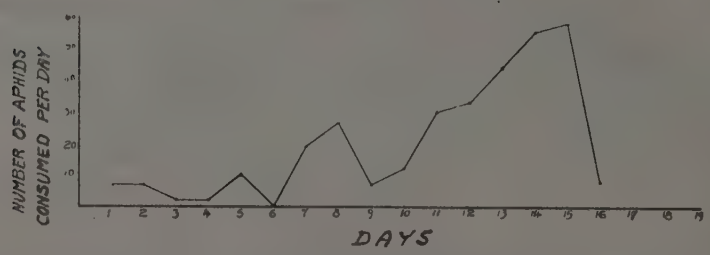
Table V

Daily rate of food consumption at different larval instars at 23° C.

INSTAR	APHIDS EATEN BY LARVA NUMBER 1	APHIDS EATEN BY LARVA NUMBER 2	APHIDS EATEN BY LARVA NUMBER 3	APHIDS EATEN BY LARVA NUMBER 4	APHIDS EATEN BY LARVA NUMBER 5	APHIDS EATEN BY LARVA NUMBER 6	APHIDS EATEN BY LARVA NUMBER 7	MEAN
1st	6	7	9	6	4	5	6	6
2nd	10	8	10	4	10	9	3	8
3rd	17	20	19	17	13	21	16	18
4th	48	41	50	37	34	50	38	43

This increase in the rate of food consumption cannot account alone for the increase in food consumption at successive instars, since the rate of food consumption at the third larval instar is only 1.3 times the rate at the two preceding instars and the rate at the fourth instar is only 1.3 times the rate at all the three previous instars.

GRAPH I



Daily food consumption by a single larva of *Leis conformis* Boisd. at 23° C. (Duration of larval instars were 3, 3, 4 and 6 days successively).

It is, also, of interest to note that prior to each moult the larva ceases to feed or feeds very little as shown in Graph I which is characteristic of all larvae.

Feeding capacity of Adults

The number of two thirds grown aphids of *Aphis durantae* consumed by seven adult beetles throughout their life was found to be 1327, 1267, 994, 1268, 2176, 1529 and 1339 respectively with an average of 1557. The daily food consumption by these adults was 28, 29, 29, 29, 30, 30 and 31 aphids respectively with an average of 29 aphids per day. This shows that while the daily food consumption of adults is greater than any of the first three larval instars it is still less than that of the fourth larval instar. In other words one can say that the last instar larva is the most voracious of all stages of development, though the total food consumption by the adult insect amounts to four times that consumed by all the larval instars; this is due to the comparatively much longer life period of the adult.

Efficiency of the Ladybird-beetle

Assuming, therefore, that the larva consumes an average of 397 aphids and the adult an average of 1557 aphids, and that the average number of eggs laid by one female is 301 eggs, it is expected, therefore, that the progeny of a single female beetle, in the first generation would consume 588,154 two-

third grown aphids of *Aphis durantae*. This represents the total number of aphids obtained under favorable laboratory condition, in which case the physical as well as the biotic resistance of the environment are reduced to a minimum. No time or very little time is spent in searching for food, competition in its various forms is negligible and limitations exerted by the physical environment are insignificant. Therefore, the efficiency of this beetle under variable field conditions, still remains to be determined.

Acclimatization

Since the beetles have not been given a fair trial under various environmental conditions in Egypt, we feel we would be doing injustice to try to deduce any results from the foregoing discussion regarding the possibilities of acclimatization. The consignments received from Australia have suffered great mortality, even the survivors have suffered greater loss in their vitality. Therefore direct liberations were impossible and we had to resort to rearing in order to produce a stock for the liberation sites.

Due to the smal number of beetles that had been reared, distribution therefore, was limited in its scope to smaller numbers released in definite localities of variable ecological features. It is probable that the number released was too small to establish a colony because it is supposed that at least 200 or more should make a satisfactory release. Hence the failure of establishment of this species in its new zoogeographical region, especially after the few recoveries obtained, might be attributed more so to the smallness of the numbers released than to the unfitness of the species in the Egyptian nitch

CONCLUSION

From recovery surveys in the few localities the species had been released. it is noteworthy to record, although the numbers obtained were too small, that it is probable that in the zones where the beetles occurred there are environmental conditions which will permit the establishment of the species which we consider to be very valuable asset to our fauna and an important check on several of our aphid species. Another attempt for importation will not be out of place nor will it be unjustifiable.

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Deux Coléoptères nouveaux pour la faune égyptienne

par J. Barbier

Xenostrongylus ovulum Frm. [Nitidulidæ].

Du 7 Avril au 5 Mai 1943, j'ai capturé une demi-douzaine d'exemplaires de cette espèce sous les feuilles traînantes d'une crucifère s'étendant largement sur le sable, à la limite des terres cultivées et des dunes de Sidi-Bishr, à Mandara (banlieue d'Alexandrie). Un exemplaire de l'espèce, qui n'était pas identifié, figure dans la collection de M. Alfieri. M. de Peyerimhoff, à qui je dois la détermination de mes captures, me confirme que le genre *Xenostrongylus* n'avait pas encore été signalé d'Egypte.

Dans une note parue au *Bulletin de la Société Entomologique de France* (1921, No. 19, pp. 281-285) sur l'éthologie des *Brachyleptus*, M. de Peyerimhoff, passant en revue le régime larvaire extrêmement varié des Nitidulidæ, classe ceux-ci en plusieurs séries à ce point de vue. Il range dans la première série « les types carnassiers, phyllophages ou anthophages », et donne les précisions suivantes : « les larves des *Cybocephalus* sont parasites des Coccides, celles des *Xenostrongylus* vivent en mineuses dans les feuilles des crucifères, celles des *Cercus* (*Cateretes*) sur les épis des Cypéracées et les Juncées, celles des *Brachypterus* sur les chatons des *Urtica*, celles des *Brachypterolus* dans les corolles des Scrophulariées, celles des *Heterhelus*, des *Pria*, des *Meligethes*, dans les fleurs les plus variées ».

J'ajoute que c'est du même endroit et sous les feuilles de la même crucifère, abondante à partir d'Avril, que j'ai capturé, en même temps que *Xenostrongylus ovulum*, trois exemplaires de *Bangasternus orientalis* Cap. (Curculionidæ) [voir : Note sur quelques coléoptères de la région d'Alexandrie, *Bull. Soc. Fouad Ier Ent.*, XXVII, 1943, p. 81]; les racines et les tiges de la même plante abritaient en abondance larves, nymphes et imagos de *Lixus anguinus* L. (Curculionidæ).

Pantomorus Fulleri Horn [Curculionidæ].

En Février 1941, j'ai capturé deux exemplaires de *Pantomorus Fulleri* Horn, sur les feuilles des arbustes constituant les massifs d'ornementation,

dans la cour et au terrain de Sports du Lycée Français, à Chatby (Alexandrie).

C'est M. de Peyerimhoff qui m'identifia l'insecte et il me communique à son sujet les précisions suivantes :

« En 1867, Crotch décrivit des Açores un curculionide sous le nom d'*Asynonychus Godmani*. Hustache (*Bulletin Soc. Ent. Fr.*, 1922, p. 100) reconnut cette espèce comme identique à celle que Horn, en 1846, avait décrite sous le nom de *Pantomorus Fulleri*, nom qui a donc la priorité. Entre temps, le même insecte était signalé, sous divers noms, des Iles Hawaï (1900), du Mexique, du Brésil, du Portugal. Puis de Sicile (Vitale, *Bull. Soc. Ent. Fr.*, 1927, p. 42), du Var (A. Clerc, *loc. cit.*, 1928, p. 290), de Rabat (*Bull. Soc. Ent. Maroc*, 1928, p. 15), d'Australie (Gurney, 1934). L'espèce se dissémine donc à travers le monde avec une extrême rapidité ».

Elle a fait maintenant son apparition en Egypte. « Partout, ajoute M. de Peyerimhoff, elle est signalée comme nuisible aux jardins potagers et aux cultures d'agrément. La larve ronge les racines, l'imago dévore les bourgeons, les feuilles et les fleurs ».

Chrysophanus phlaeas in Egypt

[Lepidoptera-Rhopalocera : Lycaenidae]

by Geoffrey C. Price

In « Die Lepidopteren-Fauna Aegyptens (*Senckenbergiana*, V, h. 1-2, 1923), Andres did not record this species from Egypt. It has however been known to occur in the Sinai. *Chrysophanus phlaeas coerulea-basalis* is an Egyptian form described by Andres (*Bull. Soc. Roy. Ent. Egypte*, XIV, 1930), from Mersa Matruh (Egypto-Cyrenaican frontier). The typical *C. phlaeas* L. has never been recorded in Egypt, proper, to the present time.

While collecting in the Giza district of Cairo (at El-Urman gardens), during the latter part of August 1945. I secured three specimens of *C. phlaeas*, two of which were in quite good condition. They were flying on the grassy areas which are a feature of these gardens, and the weather was normal to this part of Egypt.

Contribution to the knowledge of the Acarina of Egypt:

V. Five new species of Tetranychidæ

(with 55 Text-Figures)

by M. Taher Sayed,
A.R.C.S., B.Sc., D.I.C., Ph.D., F.F. I^st E.S.

In the last few years the author undertook a survey of the family Tetranychidae. This paper deals with the description of five new species.

The author takes this opportunity to tender his grateful thanks to Professor H. Priesner, previously Director of the Entomological Section, Ministry of Agriculture, and to Mohamed Soliman El-Zoheiry Bey, the present Director, for the facilities they kindly made during this work. The writer wishes also to thank Mahmoud Ismail El Okby Effendi, technical assistant of the Acarina Sub-Section, and Boutros Assaad Effendi, for their kind co-operation in the production of the drawings.

Petrobia cepae nov. spec.

(Figures 1-9)

♀. — Length, 625 μ; breadth, 447 μ.

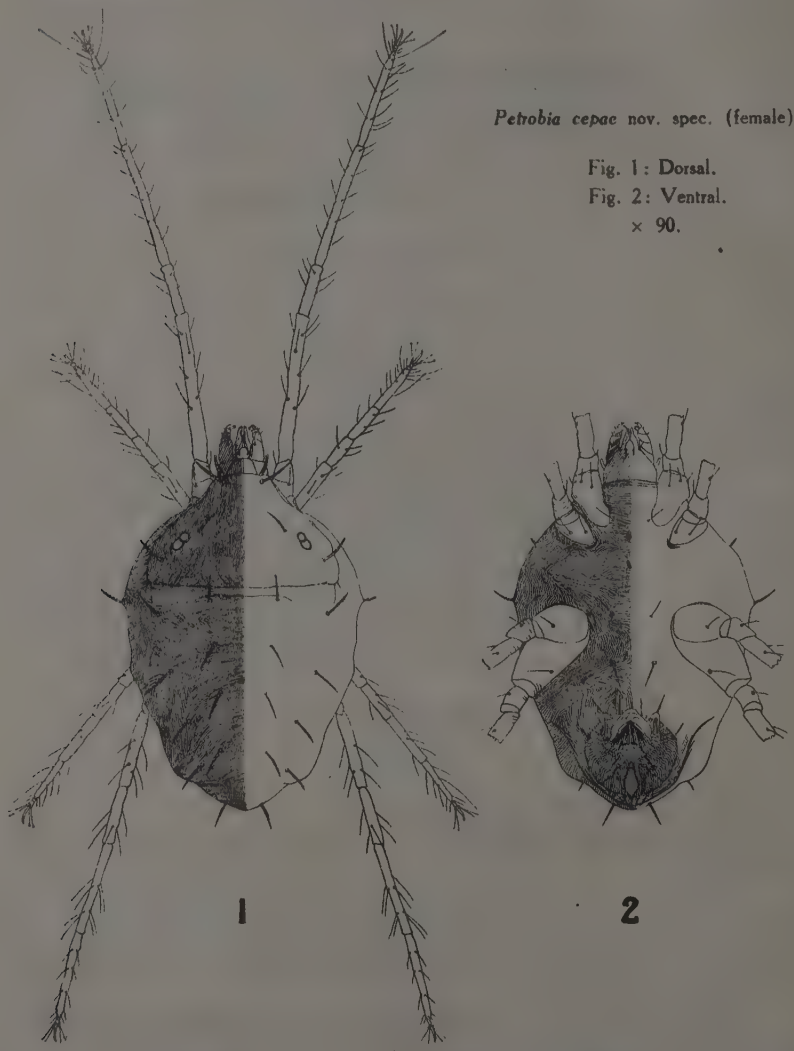
Body pitcher-like in shape and convex on dorsum; colour dark brown when alive.

Dorsal hairs, 13 pairs, short, nearly equal in length, and plumose; 3 pairs of which on propodosoma and 10 pairs on hysterosoma. The first pair lie near the anterior margin of the propodosoma and behind the protruding stigmal horns.

Dorsal transverse line between proterosoma and hysterosoma and about one third of the body anteriorly. It does not extend as far as the lateral margins as in *Petrobia lapidium* Oud. A short transverse line is often seen behind the previous one.

Eyes, two facets or corneas, the anterior one being smaller and rather round, the posterior is oval.

Dorsal striation is fine and differs from that of *Petrobia lapidium* Oud.



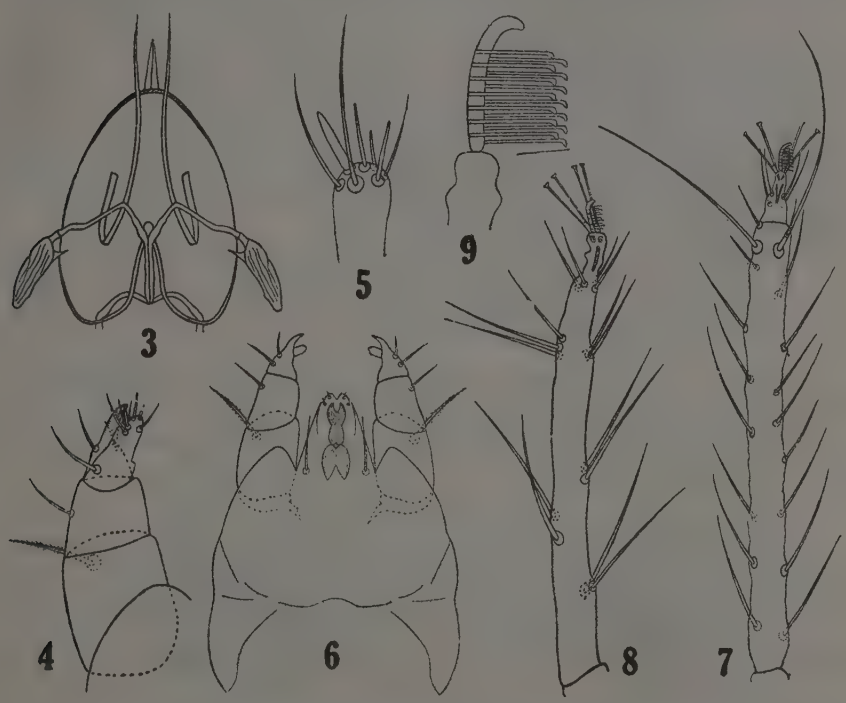
Petrobia cepae nov. spec. (female)

Fig. 1: Dorsal.
Fig. 2: Ventral.
× 90.

Collar trachea ends with a much swollen chamber forming the stigmal horn which is seen protruding at the base of gnathosoma (figs. 1 and 3).

Mandibular plate with thickened anterior margin and like that of other tetranychids in form.

Chelicera are styliform and can be much protruded. Palp ends distally with elongated thumb-like projection and a claw. On the thumb there are



Petrobia cepae nov. spec. (female)

Fig. 3: Collar trachea with stigmal horns, chelicera, and mandibular plate, × 135. — Fig. 4: Palp (basal half not drawn), × 300. — Fig. 5: Distal part of palpal thumb, much enlarged. — Fig. 6: Capitulum, × 135. — Fig. 7: Tarsus I, × 225. — Fig. 8: Tarsus IV, × 225. — Fig. 9: Claw of tarsus, much enlarged.

4 bristles or hairs, 3 strong spines and a stout blunt one which might correspond to the dorsal sensory finger of other tetranychids (figs. 4 and 5).

According to Oudemans, the palpal thumb of *Petrobia lapidium* has only five appendages. Two bristles arise from the claw. Rostrum has two pairs of small anterior bristles and a pair of hairs posteriosly.

Ventrally, the skin striation is different when compared to the dorsal one.

Ventral hairs, 13 pairs, simple and rather small, of which 3 pairs are median, one pair posterior at the extreme end of the body and 9 pairs round genitalia and anus. The latter arise from different levels.

Leg I is the longest and longer than the body. Legs II and III nearly equal and comparatively short. Leg IV rather long but shorter than leg I. Coxae I and II separate and rather narrow, while coxae III and IV are united and swollen. This swelling is more marked in coxa IV. A small crescent-like chitinised area lies at the base of coxa II. There is a pair of small bristles on each of coxae I and II. On coxae III and IV there is only a single bristle. Tarsus I divided anteriorly and ends with a sickle-shaped claw which bears seven pairs of fine tenent-like hairs on both edges forming a double comb (fig. 9). In tarsus IV, number and distribution of hairs are different. Hairs arise mostly in pairs.

When *Petrobia cepae* nov. spec. is compared to *Petrobia drummondi* Ewing, the latter is found to have a very long palp and a very small thumb. The palpal claw is rudimentary.

♂. — Unknown.

Host-plant and distribution : Onion leaves in Shandaweel (Suhag Province, Upper Egypt), in spring.

Petrobia tritici Ewing has been recorded as a pest of onions in Texas. It is also a pest of wheat.

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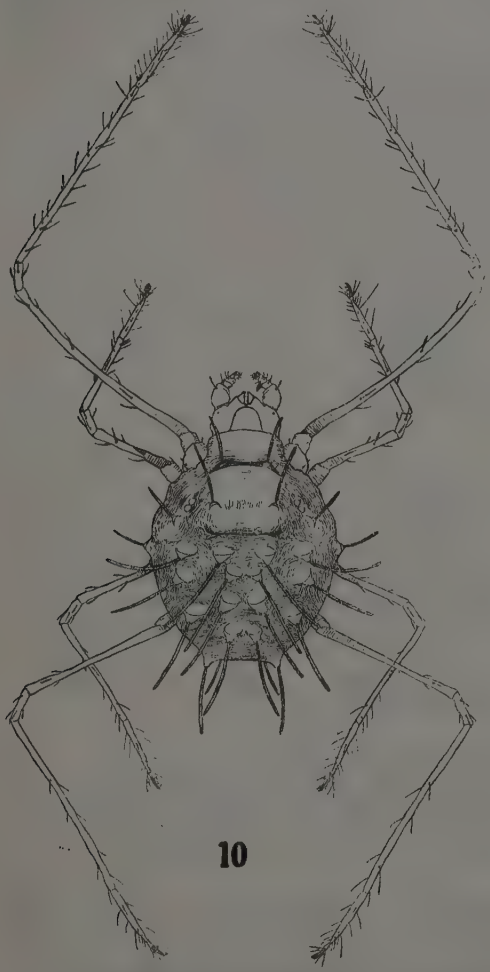
Tetranychina agerati nov. spec.

(Figures 10-19)

♀. — Length, 519 μ; breadth, 365 μ.

Shape rather round, widest equatorially; colour bright red or somewhat dark when alive.



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Tetranychina agerati nov. spec. (female)

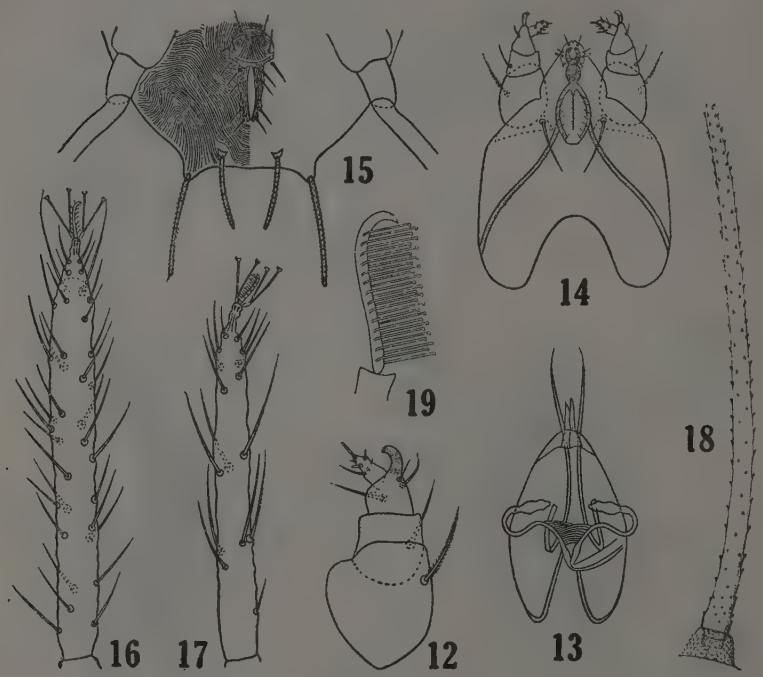
Fig. 10: Dorsal.
Fig. 11: Ventral.
× 80.

On dorsum, 12 pairs of hairs, unequally long, arising from prominent tubercles. Hairs apparently, plumose but when examined, they are found spiny and serrate. Spines are more numerous and bigger in size towards the tip (fig. 18).

Eyes, two corneas on either side about equal in size and close to each other.

A short transverse median line lies between scapular and humeral bristles or hairs.

Collar trachea (fig. 13) long, irregularly swollen in the end and, without any divisions. Its ends form the tracheal or stigmal horns at the anterior



Tetranychina agerati nov. spec. (female)

Fig. 12: Palp, × 225. — Fig. 13: Collar trachea, chelicera, and mandibular plate, × 135. — Fig. 14: Capitulum, × 135. — Fig. 15: End of abdomen, ventral, × 115. — Fig. 16: Tarsus I, × 225. — Fig. 17: Tarsus IV, × 225. — Fig. 18: Dorsal hair, × 335. — Fig. 19: Claw of tarsus, much enlarged.

margin of the cephalothorax. These do not protrude externally as in the case of *Petrobia cepae* nov. spec. above described.

Mandibular plate narrowed anteriorly where numerous papillae are found in this area.

The « digiti fixi » are not united. Chelicera styliform. Palp (fig. 12) rather stout, bearing in all 11 bristles and spines. Four unequal setae or

bristles and two stout spines rise from the palpal « thumb », five bristles on the rest of the palp. The longest is plumose and lies on the basal segment. Rostrum with four pairs of bristles and spines at the tip (fig. 14).

Ventral striation of the skin different from the dorsal one. Hairs or setae 11 pairs, small and of the ordinary type, except the last pair at the extreme end of the abdomen which is of the dorsal type. Genetalia and anus surrounded with seven pairs of small setae. Moreover, a pair of setae on each of coxae I and II, and a single seta on coxae III and IV.

Leg I is the longest and about twice as long as the body. Leg IV is the next in length, while leg II is the shortest. Tarsus I is longer than tarsus IV, and more clothed with hairs. It is divided anteriorly (fig. 16). Claw single, and forming a double-comb with 14 pairs of fine tenent-like hairs on both edges. A pair of the ordinary tenent hairs is found on either side of the claw.

♂. — Unknown.

Host-plants and distribution : On *Ageratum conyzoidis* and *Petunia hybrida* in Dokki near Cairo.

Tetranychina (*Petrobia*) *tritici* Ewing has no setae (bearing tubercles dorsally). Moreover, it has a distinct groove separating cephalothorax from abdomen, the latter being broadest anteriorly. Tarsus and tibia of leg I about equal.

In *Tetranychina macdonoughi* Mc Gregor, the whole palp bears 8 bristles. *Tetranychina harti*'s palp with 6 bristles and in it the dorsal bristles or hairs accuminate to tip (according to Mc Gregor's comparison between *T. macdonoughi* and *T. harti*). In 1935, Ewing refers to *T. tritici* as *Petrobia tritici* which was first reported on wheat and lately on onion plantations in Texas.

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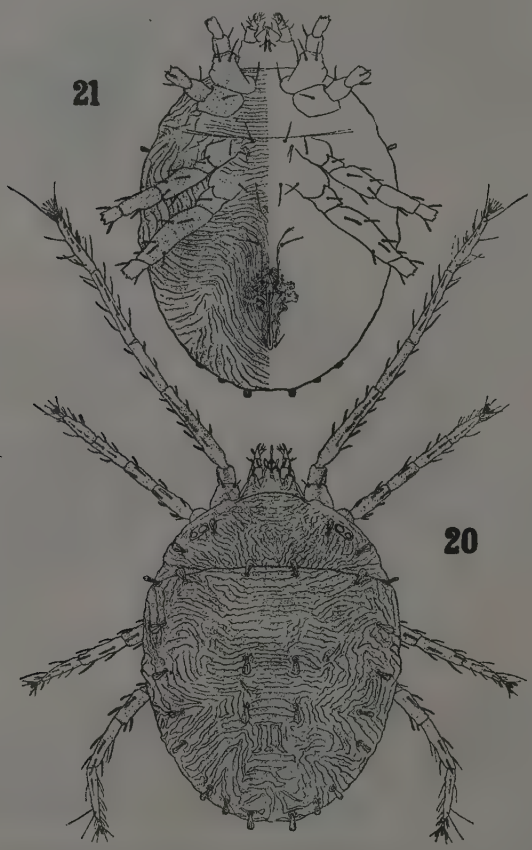
Bryobia urticae nov. spec.

(Figures 20-30)

♀. — Length, 703 μ; breadth, 536 μ.

Shape oval round; colour dark brown or dark red; body about three fourths as broad as long.



Bryobia urticae nov. spec. (female)

Fig. 20: Dorsal, × 80. — Fig. 21: Ventral, × 80.

Eyes, two corneas on each side above leg II; anterior one bigger, both oval and separate.

On dorsum, 16 pairs of short fan-like hairs, two of which on the four anterior lobes, eleven lateral and three median, all about equal in length. In *B. Sarothamni* Geijskes, dorsal hairs in both sexes are spatulate.

A dorsal, transverse, constricting line lies nearly between proterosoma and histerosoma.

Collar trachea ends with a pair of stigmal horns. The trachea runs along the external, lateral side of the horn. In *B. Sarothamni* stigmal horns are bigger and rather lumpy. Mandibular plate conical with thickened anterior part; « digiti fixi » united at the base. Palp ends distally with a cylindrical, elongated thumb which carries seven bristles; claw prominent, longer than thumb and carries two bristles. In *B. borealis* Oudemans, palpal claw is divided.

Ventrally, there are eleven pairs of ordinary small bristles or hairs, of these seven small pairs round genetalia and anus. A ventral, transverse line is found nearly opposite the dorsal one; it does not extend as far as the lateral margins.

Leg I is the longest, as long as the body (shorter than body in *B. borealis*, but longer in *B. longicornis* Ewing). Legs II and IV nearly equal in length; leg III the shortest. Tarsus provided with two claws, each with a pair of tenent hairs arising near the base. The onychium or empodium between claws carries very fine knobbed filaments forming a double comb. Tarsus I in female is shorter than tarsus I in male. In *B. praetiosa* Koch, tarsus I has two claws, four tenent hairs and onychium with two hairs only. In other tarsi the onychium is much developed, as long as the claw and bears several hairs. Moreover, there are eight pairs of tenent hairs in each tarsus. In *B. brevicornis* Ewing tenent hairs are only found in tarsus I.

♂. — Length, 500 μ.; breadth, 326 μ.

Shape oval; colour dark red.

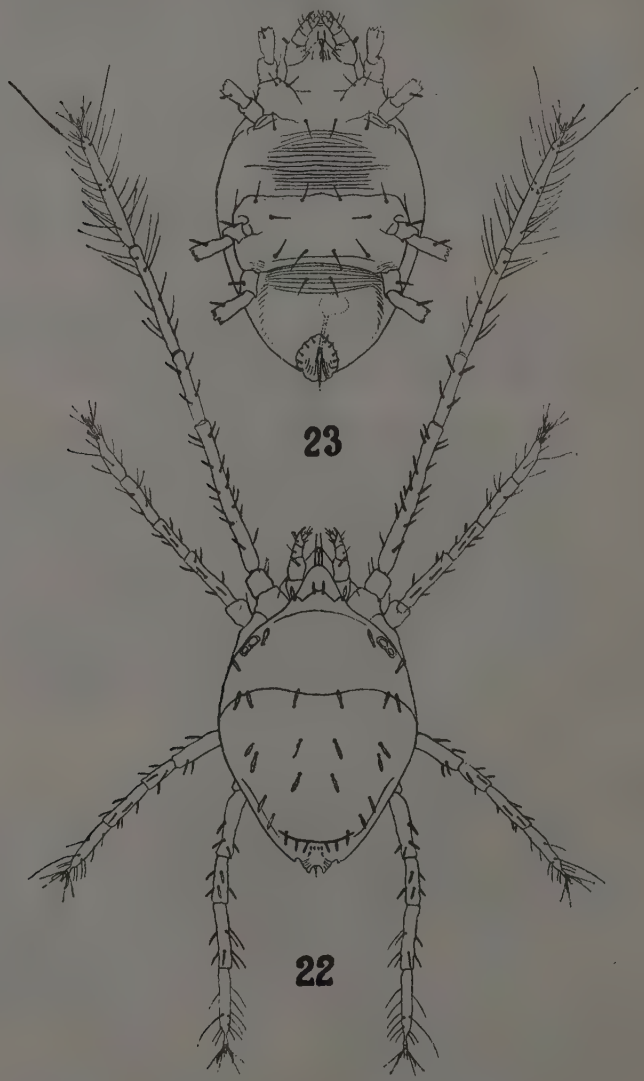
On dorsum, 16 pairs narrow spatulate hairs and three pairs small ordinary ones. The latter are found on the posterior part of the abdomen. The four anterior lobes are not so marked as in the female. There are three transverse but not horizontal lines; the first anterior in the cephalothoracic region but not always well defined, the second lies nearly between proterosoma and hysterosoma and the third in the posterior part of the abdomen.

Ventrally, fifteen pairs of hairs including those on coxae, of which five small pairs round pinus and anus and four median ones. Transverse striation in limited areas and of parallel lines.

Leg I is much longer than the body, legs II and III about equal in length, but shorter than IV.

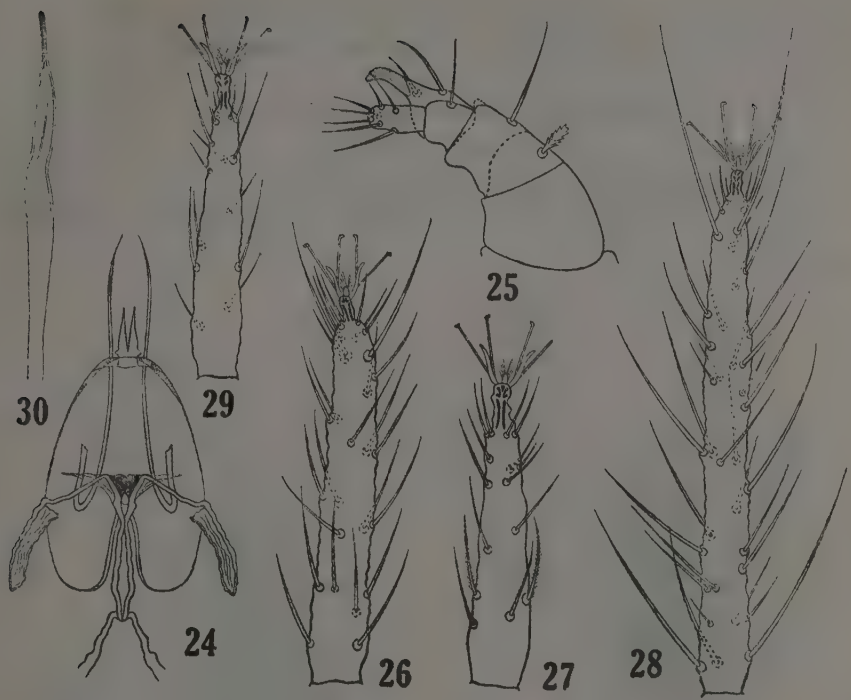
Penis long, pointed; ejaculatory duct joins its tip with the vesicula

seminalis. Penis in *B. Sarothamni* Geijskes is pointed in both shaft and inner lobe, basilar lobe protruding in between.



Bryobia urticae nov. spec. (male)

Fig. 22: Dorsal, × 120. — Fig. 23: Ventral, × 120.



***Bryobia urticae* nov. spec.**

Fig. 24: Collar trachea, chelicera, and mandibular plate, × 135. — Fig. 25: Palp (enlarged). — Fig. 26: Tarsus I (female), × 225. — Fig. 27: Tarsus III (female), × 225. — Fig. 28: Tarsus I (male), × 225. — Fig. 29: Tarsus IV (male), × 135. — Fig. 30: Penis, × 300.

Host-plants and distribution : *Urtica urens* L., *Ageratum conyzoidis*, and other weeds; sometimes found under stones. Dokki near Cairo.

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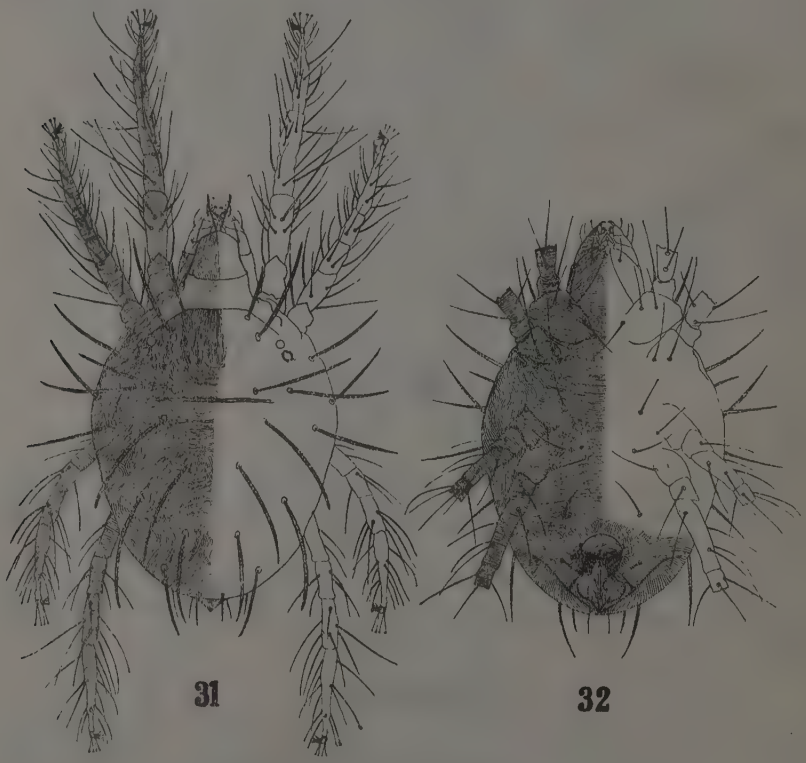
Eotetranychus cucurbitacearum nov. spec.

(Figures 31-42)

♀. — Length, 466 μ ; breadth, 282 μ.

Shape oval round ; colour dark or bright red, also greenish yellow or light brown.



Eotetranychus cucurbitacearum nov. spec. (female)

Fig. 31 : Dorsal, × 135. — Fig. 32: Ventral, × 135.

On dorsum, 13 pairs of hairs, rather long, plumose and with a basal ring. They are arranged in seven transverse rows as follows : 2, 4, 6, 4, 4, 4, 2. The first three rows lie in the propodosoma area, the rest in the hysterosoma.

A short, transverse, dorsal line, about one-half the breadth of the body lies between third and fourth rows of hairs in the anterior part of the hysterosoma. This line is missing in *Eo. telarius* L., *Eo. carpini* Oud., *Eo. neocaledonicus* André, and *Eo. inexspectatus* André. Another transverse line runs anteriorly between gnathosoma and propodosoma. It turns obliquely on both sides. The latter is not well defined. Dorsal striation differs from that of *Eo. telarius* as illustrated by Oudemans.

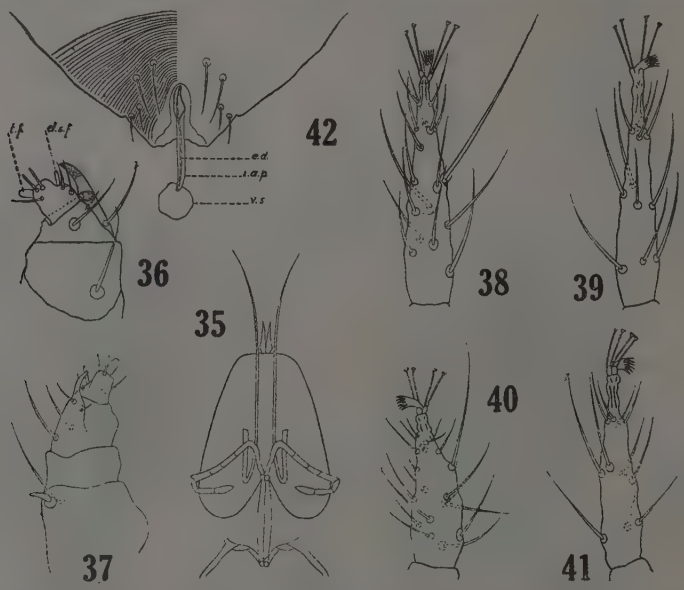
Eotetranychus cucurbitacearum nov. spec. (male)

Fig. 33: Dorsal, × 135. — Fig. 34: Ventral, × 135.

Eyes, two corneas, separate, anterior one rather round and somewhat smaller. In *Eo. neocaledonicus*, anterior cornea oval, much bigger than the posterior one which looks like a narrow slit. In *Eo. inexspectatus* corneas are semi-oval. They do not seem separate in *Eo. telarius*.

Collar trachea (fig. 35) rather long, arms bent backwardly, divided into six chambers, end chamber somewhat swollen. In some specimens only five are easily seen. Chambers are four in *Eo. telarius* and only two in *Eo. neocaledonicus*.

Mandibular plate conical and of the normal type; « digiti fixi » free anteriorly. Chelicera styliform and is much protruded. Palp with prominent claw and thumb. The terminal finger is longer than broad. Both the dorsal sensory finger and the terminal finger are well developed and between them lie two nail-like spines. In addition there are three ordinary bristles. Ventrally, 10 pairs of relatively small, entire bristles. Five pairs of these round genetalia and anus and one pair at posterior end of the body. Moreover,



Eotetranychus cucurbitacearum nov. spec.

Fig. 35: Collar trachea, chelicera, and mandibular plate (male), × 135. — Fig. 36: Palp [*d.s.f.* = dorsal sensory finger; *t.f.* = terminal finger] (female), × 300. — Fig. 37: Palp (male), × 300. — Fig. 38: Tarsus I (female), × 225. — Fig. 39: Tarsus IV (female), × 225. — Fig. 40: Tarsus I (male), × 225. — Fig. 41: Tarsus IV (male), × 225. — Fig. 42: Posterior part of abdomen in male showing penis, ejaculatory duct and vesicula seminalis [*e.d.* = ejaculatory duct; *i.a.p.* = inner arm or lobe of penis; *v.s.* = vasicula seminalis], much enlarged.

there is a pair on each of coxa I and II and a single bristle on each of coxa III and IV.

Ventral striation is well illustrated in figure 32.

Tarsus I in both sexes ends with the ordinary four tenent hairs. The empodium or onychium is split into six needle-like appendages. The two small sensory hairs as illustrated by Oudemans in the case of *Eo. telarius* are represented here. Tarsus IV in both sexes slender and with less bristles.

♂. — Length, 368 μ ; breadth, 131 μ.

Shape, oval or like an inverted spindle ; colour, bright brown when alive. Body much narrower than female and tapers posteriorly.

Dorsal hairs 13 pairs arranged as in female in seven transverse rows. Transverse, dorsal lines are three but none of them extend as far as the lateral margins. In some specimens only two of them are seen.

Ventrally, there are 8 pairs of bristles, 4 of which small and surround penis and anus. In addition there are three pairs on coxae. At the base of coxa II there is a small chitinised area.

A transverse, but not straight line, lies ventrally in the posterior part of the abdomen. This is missing in *Eo. pruni* Oud.

Palp with a nail-like spine in the external angle of the fourth basal segment (fig. 37).

Penis, shaft much chitinised, inner arm or lobe long. Ejaculatory duct joins vesicula seminalis with apex of penis.

Host-plants and distribution : It is the common red spider mite of Egypt and is prevalent all over the country. It infests several weeds, shrubs and trees and could be found all the year round as it does not hibernate. It is naturally more active in summer. Among host-plants of economic value are *Ficus carica*, *Citrullus vulgaris* and other cucurbits, *Arches hypogaea*, *Phaseolus vulgaris*, *Vicia faba*, *Gossypium barbadense*, *Trifolium alexandrinum*, *Solanum melongena*, etc.

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Paratetranychus terminalis nov. spec.

(Figures 43-55)

♀. — Length, 387 μ; breadth, 212 μ.

Shape oval round; colour dark red when alive.

On dorsum twelve pairs of hairs moderately long, plumose with a basal ring and arranged in six transverse rows 2, 4, 6, 4, 4, 4.

Eyes, two corneas in the anterior lateral part of the body and nearly above leg II. Anterior cornea round, smaller, and more distinct than posterior one. A transverse but incomplete line runs in the middle of the abdomen. Alive specimens show dorsal, transverse wrinlkes. Body and legs striated dorsally as illustrated.

Collar trachea relatively long, undulating and swells irregularly at the end. Mandibular plate about one and half as long as broad with anterior emargination. « Digiti fixi » separate; chelicera styliform (fig. 47). Palp four-segmented, the distal segment being the smallest and known as the palpal « thumb ». Terminal finger more broad than long. Two unequal in length rod-like setae are found near the terminal finger, also three ordinary setae and a small slender dorsal sensory finger (fig. 48). Rostrum lies between palpi and has two short nail-like setae anteriorly.

Leg I the longest, the rest nearly all equal in length. Legs III and IV slender when compared to I and II. Tarsi I and II relatively stout and clothed with more hairs. All tarsi are divided near the tip. Tarsal claw single; at a point one-third its length from its base arises the onychium with 10 fine capitate or knobbed filaments. These are equally arranged on two edges.

Ventral hairs, 10 pairs, rather short, entire and median in position. Three pairs lie between coxae I-III, and IV. One pair anterior to genetalia, another at extreme end of the abdomen and five pairs round genetalia and anus. Of the latter, two pairs round anus are comparatively small. Moreover, a pair of bristles on each of coxa I and III, a single bristle on coxa III and IV.

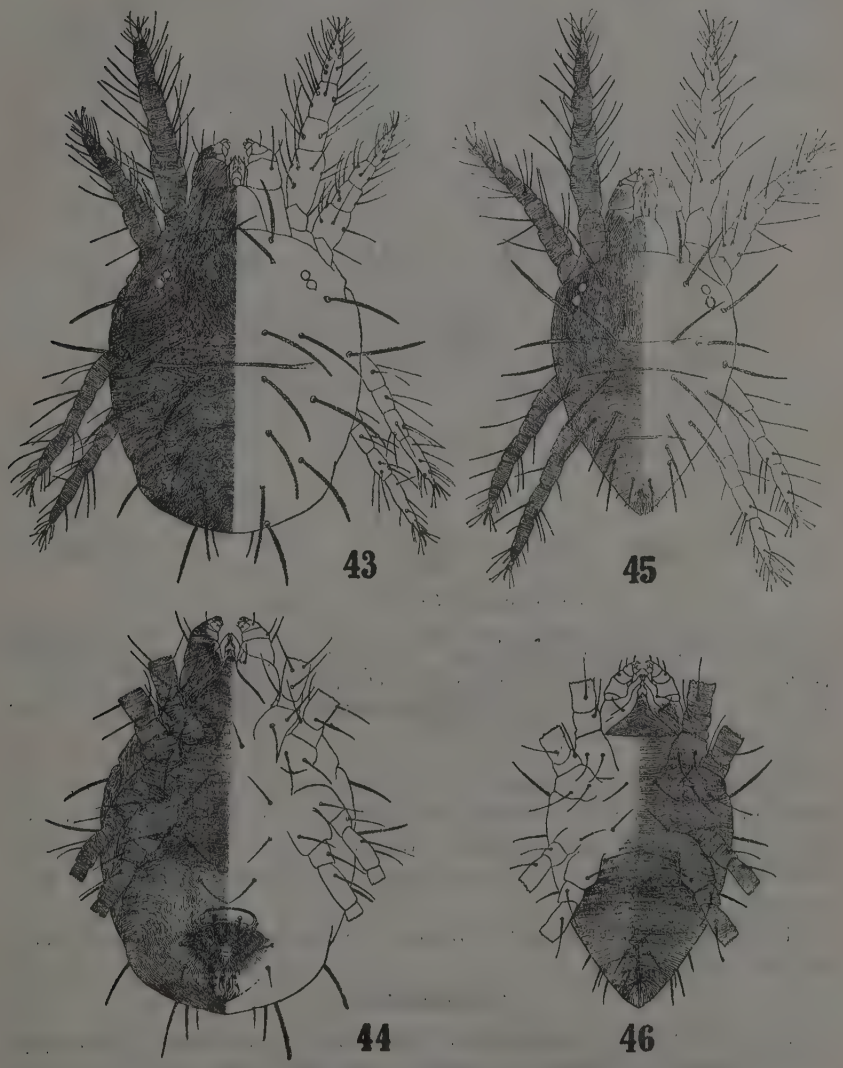
The ventral skin-striation is different from the dorsal one.

♂. — Length, 337 μ; breadth, 195 μ.

Triangular in shape and dark red when alive. On dorsum, 13 pairs of comparatively long plumose hairs arranged in seven transverse rows : 2, 4, 6, 4, 4, 4, 2. In *P. trinitatis* Hirst, which is found on grape vine in Trinidad, dorsal hairs in the male are 13 pairs not including the finer hairs near the anus. They are much smaller and less pectinated. Transverse lines are three, of which the anterior one is not distinct and none of them extend as far as the lateral margins.

Eyes, two corneas, separate, the anterior smaller and both oval.

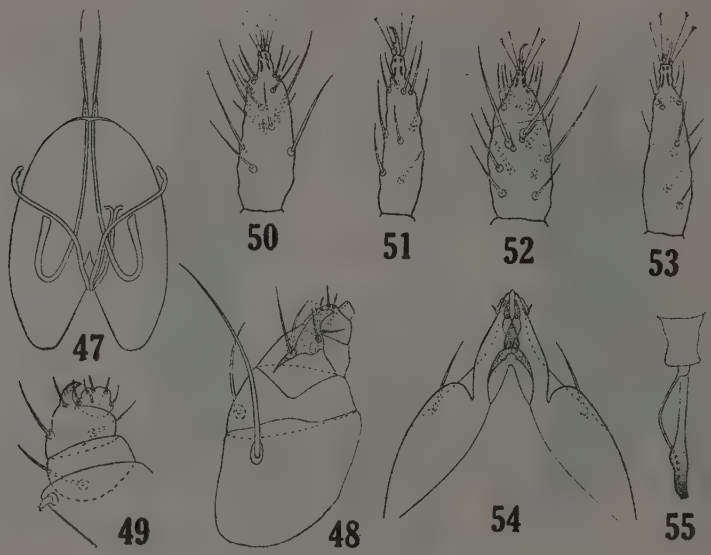
Palp differs from that of female in being smaller and in having a short



Paratetranychus terminalis **nov. spec.**

Fig. 43: Dorsal (female), × 150. — Fig. 44: Ventral (female), × 150. — Fig. 45: Dorsal (male), × 150. — Fig. 46: Ventral (male), × 150.

and thick spine on the anterior angle of the fourth basal segment and near the adjacent segment. The terminal finger is missing and the whole palp seems to be smaller than in female.



Paratetranychus terminalis nov. spec.

Fig. 47 : Collar trachea, chelicera, and mandibular plate, × 225. — Fig. 48 : Palp (female), × 300. — Fig. 49 : Palp (male), × 300. — Fig. 50 : Tarsus I (female), × 225. — Fig. 51 : Tarsus IV (female), × 225. — Fig. 52 : Tarsus I (male), × 225. — Fig. 53 : Tarsus IV (male), × 225. — Fig. 54 : Rostrum (male), × 300. — Fig. 55 : Penis with ejaculatory duct and vesicula seminalis, × 300.

Pennis (fig. 55) of moderate size, chitinised and curved at the tip. The ejaculatory duct joins the vesicula seminalis with the tip of the penis. Ventrally, striation is of nearly parallel, transverse lines. Ventral hairs 9 pairs (excluding those on coxae and gnathosoma), of these 5 pairs round penis and anus.

Host-plants : *Mangifera indica*, *Terminalia* spec., *Eugenia gambolana* and *Vitis vinifera*.

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Description of *Tenuipalpus granati* nov. spec. and *Brevipalpus pyri* nov. spec.

[Acarina : Trichadenidae]

(with 2 Text-Figures)

by M. Taher Sayed,
A.R.C.S., B.Sc., D.I.C., Ph.D., F.F. 1st E.S.

In 1875, Donnadieu created the genera *Tenuipalpus* and *Brevipalpus* and placed them in *Tetranychidae*. The characters of *Tenuipalpus* as given by Donnadieu are not limiting when the other genus is considered. The species he included in *Tenuipalpus* are *palmatus*, *spinosus* and *glaber*. The first species differs from the other two among other things, in shape, chaetotaxy and skin striation. Baker (1945) has limited the genus to the *palmatus* group and enumerated its characteristics.

Brevipalpus has been synonymised with *Tenuipalpus*.

Since *obovatus* is the type species of *Brevipalpus*, there is much in common between Donnadieu's conception of this genus and ours. In contrast with *Tenuipalpus*, this genus is characterised by the presence of skin reticulations, the two ventral hysterosomal plates are clear and the hysterosoma is not much narrowed when compared to propodosoma. *Tenuipalpus spinosus* Donn., *T. glaber* Donn., *T. oudemansi* Geijskes, *T. phoenicis* Geijskes, and *T. cactorum* Oud. are thus conveyed to the genus *Brevipalpus*.

Recently, Oudemans has put both *Tenuipalpus* and *Brevipalpus* in *Trichadenidae* Oud. 1938. The family includes also *Trichadenus* Rondani 1870, *Raoiella* Hirst 1924, *Phyllotetranychus* Sayed 1938, and *Tegopalpus* Womersley 1940.

Trichadenidae has replaced *Pseudoleptidae* Oud. 1928, which included *Pseudoleptus* Bruyant 1911 (synonym : *Trichadenus* Rondani 1870) and *Raoiella* Hirst 1924.

In 1938, and again in 1942, the writer has stated that there is much in common between the genus *Tenuipalpus* and those of *Pseudoleptidae*. The

stripped invagination as termed by Oudemans, the respiratory apparatus in the cephalothoracic region, the cylindrical palpi and the tarsi are common features.

Raoiella Hirst and *Phyllotetranychus* Sayed differ from all tetranychid genera in having two-segmented palp and hence the author has placed them in the sub-family *Pseudotetranychinae* Sayed 1938. In *Phyllotetranychus* the basal segment of the palp is fused with the hypostome.

The writer (1942) has discussed the genus *Tenuipalpus* in Egypt. He recorded *Tenuipalpus orchidarum* Parfitt on pomegranate and vineyards, *T. oudemansi* Geijskes on apples, pears, plums, apricots, and some ornamental plants; also *T. obovatus* Donnadieu on citrus, guava and occasionally on plums and apricots.

The writer has reexamined material, together with Oudeman's and Geijske's descriptions and found out that the mites recorded as *Tenuipalpus orchidarum* and *T. oudemansi* are new species. The ventral view of the female and male pomegranate mite is redrawn because the three pairs of hairs on the anterior part of the hysterosoma are actually somewhat longer than already illustrated.

The writer takes this opportunity to thank Mr. Edward W. Baker, of the United States Department of Agriculture (Bureau of Entomology and Plant Quarantine) for his kind help and advice.

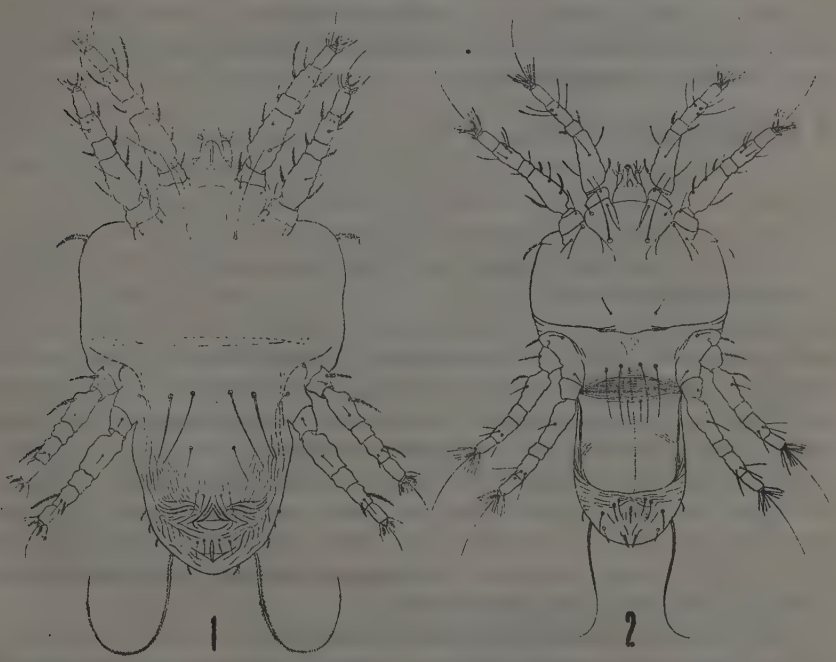
1. Tenuipalpus granati nov. spec.

Body somewhat oval and flat; colour darkish red when alive.

♀. — Length, 280 μ; breadth 166 μ.

Eyes two corneas, unequal in size, close together and near base of leg II. The transverse line between propodosoma and hysterosoma is not well defined laterally. Propodosoma extends anteriorly into two triangular projections overlapping posterior part of capitulum. Striations on dorsum not reticulate. Hairs, three dorsal pairs on proterosoma, lateral one the longest, three median small ones on hysterosoma, seven pairs on its lateral and posterior margins, the long whip-like hair included. The striated pouch or stripped invagination as termed by Oudemans usually found in *Tenuipalpus* and *obovatus* species not distinct. Transverse parallel striations found under the anterior margin of propodosoma; anterior V-shaped tracheae end with stigmata, posterior tracheae present. Chelicera styliform; mandibular plate with two distinct lobes and much narrowed apex. Palp four-segmented, proximal segment very small, distal one short and cylindrical, second segment long and striated, penultimate one small and rounded. In *Tenuipalpus orchidarum* palp three-segmented.

Ventrally, no plates and only few striations on posterior end of hysterosoma. Hairs, fourteen pairs, seven pairs near coxae included, simple and mostly on hysterosoma. Three pairs of hairs on hysterosoma, two of these rather long and anterior, the third comparatively short and posterior; four small pairs round genetalia and anus. Coxae III and IV arise ventro-laterally.



Tenuipalpus granati nov. spec.

Fig. 1. — The female, ventral aspect, × 250.
Fig. 2. — The male, ventral aspect, × 220.

Leg IV not extending beyond abdomen. Tarsi I and II (fig. 18, 1942) comparatively bigger than III and IV, and provided with external finger-like projections; empodial claws furnished with several, lateral filaments. Anus subterminal; vulva surrounded with identical striations.

♂. — Smaller than female; length, 274 μ; breadth, 144 μ; hysterosoma much narrowed and cylindrical in shape.

Ventrally, a transverse line anterior to leg III and several spindle-shaped, transverse lines at the anterior part of hysterosoma are found. Th latter may serve in the twisting of the abdomen upwardly when the male is copulating. Hairs, fourteen pairs, seven pairs near coxae included, three small

pairs at posterior end of hysterosoma and a small pair in the propodosoma and in front of the transverse line, three pairs comparatively long and on anterior part of hysterosoma. In *T. orchidarum* two of the three corresponding pairs about as long as the hysterosoma and the chaetotaxy is quite different. Two rod-like spines at the end of abdomen and serve to support penis. Ejaculatory duct long and funnel-shaped anteriorly.

Host-plants and distribution : Found in Lower and Upper Egypt on rather limited vineyards; also on leaves, small branches and occasionally fruits of pomegranate.

2. Brevipalpus pyri nov. spec.

Body oval round and flat; colour bright red in female when alive, lighter in male.

♀. — Length, 321 μ; breadth, 170 μ.

Eyes, two facets or corneas, anterior one being smaller, both oval and situated anterio-laterally.

Dorsal transverse constricting line between proterosoma and hysterosoma and about one-third of the body anteriorly. A longitudinal, dorsal median ridge, along the whole body is only seen in alive specimens. Dorsal shield reticulate, the net-work structure rather even. Anteriorly propodosoma projects into a triangular part overlapping gnathosoma. The projection splits vertically and extends laterally as far as a point dorsal to coxae II. Median triangular part of projection more chitinised than lateral one. Hairs, on dorsum plumose and 26 in number. A pair on the anterior triangular projection and two pairs lateral, near eyes. Hysterosoma provided with three median pairs and eight lateral and posterior ones.

Anterior breathing apparatus rather complicated. A funnel-shaped structure of longitudinal, parallel striations termed as the stripped invagination or the striated pouch by Oudemans is found anteriorly. A V-shaped tube or trachea runs anteriorly along the sides of the funnel and ends with a pair of stigmata. This tube runs posteriorly and turns anteriorly giving rise to a lateral trachea with swollen ends.

Mouth-parts : chelicera styliform and can be protruded considerably; palp four-jointed, distal segment short and bears three plumose hairs; two similar hairs on penultimate segment and one on second segment.

Ventrally, the network structure is only limited as illustrated. Metapodosoma well defined, rectangular with a small, anterior pair of hairs and a long, posterior one and thus differing from *Tenuipalpus oudemansi* Geijskes. In propodosoma, posterior to coxa I, two pairs of very small, chitinised areas are found. Two ventral plates at posterior end of hysterosoma distinct; anterior plate rectangular, reticulate with a pair of hairs; posterior one,

somewhat triangular and with two pairs of hairs. Legs constricted; leg IV does not extend beyond abdomen. Tarsi with two well developed claws, four tenent hairs and numerous short, fine hairs on the bifid empodium. Tarsi III and IV not as pointed as in *Tenuipalpus oudemansi*. Tarsus I with two long, dorsal hairs, two lateral, spindle-like setae and two ventral short ones. The blunt sense hair on tarsus I of *Tenuipalpus oudemansi* is missing.

♂. — Length, 269 μ; breadth, 121 μ.

Body oval and smaller than female, reticulate. On dorsum, the constricting line between proterosoma and hysterosoma distinct. Another line lies between metapodosoma and opisthosoma. Number of dorsal and lateral hairs same as in female but comparatively longer. Anterior, median, triangular projecton not split into two.

Ventrally, about ten transverse, parallel lines on anterior part of opisthosoma, posterior line being very short. In this area the body looks as if segmented. These lines are apparently used in the twisting of the posterior, abdominal part upwards to adjust the male genetalia in the vulva. Two triangular lobes, which can be seen dorsally as well, as present on the extreme end of the body. The apex of each lobe is provided with three, small, plumose setae or hairs. A pair of long, rod-like spines found posteriorly and serve to support penis when ejected. Penis rather long and slender, surrounded by a sheath; vesicula seminalis spherical and comparatively big.

Host-plants and distribution : On apples, pears, plums, apricots and others, all over the country.

3. Brevipalpus obovatus Donnadieu

The writer (1942) has described this species in detail under *Tenuipalpus obovatus*.

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Les espèces égyptiennes du genre *Ammophila* Kirby

[Hymenoptera-Aculeata : Sphecoidea-Sphecidae]

(avec 157 Figures)

par Anastase Alfieri

Les quatre genres *Sphex* Linné, *Ammophila* Kirby, *Sceliphron* Klug (*Pelopoeus* Latreille) et *Neosphex* Reed (*Pseudosphex* Taschenberg) forment un groupement très naturel, les Sphecidae Auctt. (= Gattungsgruppe *Sphex* Kohl).

Les espèces égyptiennes du Genre *Sphex* ont fait l'objet d'un travail publié par feu le Docteur A.-M. Honoré dans ce Bulletin, en 1944.

Sceliphron (*Pelopoeus*) *spirifex* Linné [1758] et *Sceliphron* (*Chalybion*) *Targionii* Carr. [1872] sont les seuls représentants égyptiens du genre *Sceliphron* Klug.

Neosphex Reed est un genre sud-américain inconnu en Egypte.

Voici maintenant une révision des espèces égyptiennes du Genre *Ammophila* Kirby [1798].

Le groupement des Sphecidae est caractérisé par :

(1) Un pétrole vrai, formé par l'allongement styliforme du premier sternite, seul, ou concurremment avec le premier tergite.

(2) L'insertion de la nervure basale sur la subcosta très éloignée du ptérostigma, avec une cellule radiale arrondie, sans cellule appendiculaire.

(3) Deux éperons aux tarses intermédiaires.

(4) Pas d'aire pygidiale dans les deux sexes.

(5) En principe, un peigne tarsal chez la femelle.

Dans le groupe, les Ammophiles se distinguent comme suit :

Aux ailes antérieures, les deux nervures récurrentes aboutissent toutes les deux dans la seconde cellule cubitale, caractère commun avec le genre *Sceliphron* ; chez les *Sphex*, les deux nervures récurrentes aboutissent l'une dans la deuxième cellule cubitale, l'autre dans la troisième.

Sceliphron est facile à distinguer par le manque d'épines aux tarses et l'absence de peigne tarsal chez la femelle. *Neosphex* est un genre à nervulation très spéciale.

La séparation des genres *Sphex* et *Ammophila*, d'après le mode d'insertion des nervures récurrentes, n'est pas toujours rigoureuse; mais, en ce qui concerne nos espèces, on peut recourir aux caractères suivants :

(1) Un pétiole bi-articulé, au sens large du mot, indique toujours une Ammophile.

(2) Chez les Ammophiles à pétiole strictement uni-articulé, les ongles des tarses ne sont pas dentés, ou possèdent seulement une dent très peu visible.

J'entends par *Ammophila* le genre décrit et nommé par Kirby en 1798 (espèce-type *Ammophila sabulosa* Linné [1758]), tel qu'il a été compris par la plupart des auteurs et maintenu comme tel suivant décision de la Commission Internationale de Nomenclature en 1935 (*cf.* Dr. A.-M. Honoré : Espèces-Types des genres de Sphégides Paléarctiques, dans ce Bulletin, 1943, pp. 29-56).

Subdivisions du Genre

Le genre *Ammophila* a été divisé en un certain nombre de sous-genres d'inégale valeur, fondés sur des critériums peu convaincants; pour une faune locale comme la nôtre, il n'y a guère que deux divisions à retenir : *Podalonia* (olim *Psammophila*) et *Ammophila*, celle-ci englobant toutes les autres.

Voici, à titre documentaire, les diverses subdivisions en question, avec leurs caractères, et la liste des espèces de la faune égyptienne qui s'y rapportent :

(1) *Podalonia* Spinola [1851] (*Psammophila* Dahlbom [1842], non T. Brown [1827]). — Pétiole uni-articulé; trois cellules cubitales; ongles non dentés, ou avec une très petite dent.

A. atrocyanea Eversmann [1849], et sa variété *massinissa* Morice [1900], *micipsa* Morice [1911], *Schmiedeknechti* Kohl [1898], *minax* Kohl [1906], *Tydei* Guillou [1841], *dispar* Taschenberg [1869], *affinis* Kirby [1798], *hirsuta* Scopoli var. *ebenina* Spinola [1838].

(2) *Parapsammophila* Taschenberg [1869]. — Pétiole pseudo-biarticulé; ongles bidentés :

A. cyanipennis Lepeletier [1845] (*miles* Taschenberg [1869]), *lateritia* Taschenberg, ♀ [1869] (*monilicornis* Morice, ♂ [1900]).

(3) *Eremochares* Gribodo [1882]. — Pétiole pseudo-biarticulé; ongles des tarses uni-dentés :

A. lutea Taschenberg [1869], *algira* Kohl [1901], *caelebs* Kohl [1906], *dives Brullé* [1832], *dolichostoma* Kohl [1906].

(4) *Miscus* Jurine [1807]. — Troisième cellule cubitale pétiolée :

Aucune espèce en Egypte.

(5) *Coloptera* Lepeletier. — Deux cellules cubitales :

Aucune espèce en Egypte.

(6) *Ammophila* (s. str.) Kirby [1798]. — Pétiole bi-articulé ; deux cellules cubitales ; ongles non dentés :

A. haimatosoma Kohl [1883], *dubia* Kohl [1906], *gracillima* Taschenberg [1869], *producticollis* Morice [1911], *quadraticollis* Costa [1893], *strumosa* Kohl [1906], *hemilauta* Kohl [1906], *nasuta* Lepeletier [1845], *egregia* Mocsary [1881], *propinqua* Taschenberg [1869], *erminea* Kohl [1906], *Honorei* nov. spec.

Distinction des Sexes

Les mâles ont 13 articles au funicule des antennes, les femelles en ont 12 ; les femelles ont également un peigne tarsal, et sont plus grandes et plus robustes que les mâles correspondants.

Biologie

Le nid est toujours creusé dans le sol, approvisionné, en principe, avec une ou plusieurs chenilles ; mais les modalités d'approvisionnement diffèrent assez sensiblement suivant les espèces.

Un premier groupe biologique comprend des espèces du sous-genre *Podalonia* (*hirsuta*, *affinis*, *Tydei*, et autres), qui chassent d'abord leur proie, creusent ensuite un nid et le clôturent définitivement après approvisionnement. Les proies sont généralement des chenilles de Noctuelles (*Agrotis*, etc.) menant une vie souterraine, mais peuvent être aussi des chenilles à vie aérienne (*Lymantria* [Lepeletier], *Cucullia* [Ferton]), ou même des chenilles velues de Diurnes (*Epinephele* [Ferton]).

Ammophila haimatosoma appartient également à ce groupe.

Un autre groupe, comprenant la plupart des *Ammophila* s. str., dont les mœurs sont connues, creusent d'abord le nid, puis l'approvisionnent avec des proies multiples, de plus petite taille que celle des proies du groupe précédent ; ce sont généralement des chenilles arpenteuses (Phalenides), mais peuvent être également des chenilles de Diurnes (*Pararge* [Berland]).

A. (*Miscus*) *campestris* se rattache à ce groupe, mais avec une proie différente. Cette Ammophile chasse des larves de Tenthrédinides, dites aussi fausses-chenilles.

Enfin, Smirnow a observé en Transcaspie *A.* (*Eremochares*) *dives* Brullé capturant des Orthoptères non spécialement spécifiés, mais qui doivent probablement être des Locustides.

TABLES POUR LA DETERMINATION DES ESPECES

Femelles

1. Pétiole court, formé par le premier sternite seul régulièrement aminci ; le tergite correspondant, de forme normale, plus large que long, est inséré à l'extrémité du sternite suivant un angle presque droit (vu de profil) ; le pétiole est plus court que l'ensemble du restant de l'abdomen (*Podalonia*) 2

—. Pétiole formé de deux articles, le premier sternite et le premier tergite, uniformément allongés et placés bout à bout ; le pétiole est nettement plus long que l'ensemble du restant de l'abdomen (*Ammophila*) 15

—. Pétiole formé de deux articles comme ci-dessus, mais le tergite est moins rétréci d'avant en arrière, en forme de cône allongé, et inséré à l'extrémité du sternite suivant un angle très ouvert (vu de profil) ; le pétiole, ainsi compris, est sensiblement égal au restant de l'abdomen 10

2. Corps entièrement noir ou d'un bleu brillant 3

—. Abdomen plus ou moins rouge 7

3. Pulvilli rudimentaires ..... *ebenina* Spinola

—. Pulvilli bien développés 4

4. Abdomen d'un beau bleu brillant 5

—. Abdomen noir, plus ou moins brillant, mais sans coloration bleue bien nette 6

5. Taille dépassant 18 mm.. Mésopleures assez grossièrement ridées ..... *atrocyanea* Eversmann

—. Taille inférieure à 17 mm.. Mésopleures obliquement striées et ponctuées entre les stries ..... *atrocyanea* var. *massinissa* Morice

6. Aire dorsale du segment médiaire très finement et régulièrement striée ; une très petite dent à la base des ongles des tarses ; hanches antérieures dentées ..... *micipsa* Morice

—. Aire dorsale du segment médiaire à striation plus grosse, pouvant devenir confluente ; ongles des tarses et hanches antérieures non dentés ..... *Schmiedeknechti* Kohl

7. Tibias et tarses antérieurs rougeâtres, tarses et tibias intermédiaires également plus ou moins colorés. Hanches antérieures portant à leur extrémité une épine courte et aiguë ..... *minax* Kohl

—. Pattes entièrement noires. Pas d'épines aux hanches antérieures 8

8. Pulvilli bien développés 9

—. Pulvilli rudimentaires. Ailes antérieures nettement enfumées, plus claires vers la base ; ailes inférieures légèrement colorées ..... *dispar* Taschenberg

9. Aire dorsale du segment médiaire chagrinée. Ailes antérieures presque incolores, légèrement enfumées à l'apex ..... *Tydei* Guillou
—. Aire dorsale du segment médiaire finement striée ..... *affinis* Kirby
10. Ongles des tarses présentant deux dents à leur bord interne. Bord antérieur du pronotum plus ou moins arrondi, la face antérieure perpendiculaire (*Parapsammophila*) 11
—. Ongles des tarses ne présentant qu'une seule dent à leur bord interne. Bord antérieur du pronotum plus ou moins arrondi, la face antérieure non perpendiculaire (*Eremochares*) 12
11. Ailes incolores (ou presque). Bord antérieur du clypéus tronqué, les angles latéraux dentiformes ..... *lateritia* Taschenberg
—. Ailes très enfumées, avec des reflets violacés. Angles latéraux de la troncature du clypéus non dentiformes ..... *cyanipennis* Lepeletier
12. Les cinq articles des tarses antérieurs asymétriques, le lobe externe du premier article fortement allongé en un appendice digitiforme 13
—. Articles des tarses antérieurs normaux, tout au plus le premier article quelque peu dilaté 14
13. Pattes et abdomen d'un ferrugineux clair. Partie antérieure du mésonotum arrondie ..... *lutea* Taschenberg
—. Pattes noires ou d'un ferrugineux foncé, abdomen brun rouge, noir sur les trois derniers segments ..... *algira* Kohl
14. Milieu du mésosternum dilaté en une protubérance nettement accusée, en soc de charrue ..... *dives* Brullé
—. Milieu du mésosternum arrondi, ne présentant, vu de profil, pas de protubérance bien nette ..... *dolichostoma* Kohl
15. Pattes noires ; corps noir, abdomen bleu d'acier ..... *Honorei* nov. spec.
—. Pattes rouges, au moins en partie ; corps non entièrement noir, plus ou moins rouge sur les premiers segments, les derniers pouvant avoir des reflets bleu d'acier 16
16. Pulvili rudimentaires. Corps généralement d'un rouge foncé, avec les trois ou quatre derniers arceaux de l'abdomen d'un bleu brillant .... *haimatosoma* Kohl
—. Pulvilli bien distincts 17
17. Pronotum très développé, à peu près aussi long que large 18
—. Pronotum court, deux fois aussi long que large 19
18. Pronotum couvert en dessus de stries transversales très visibles .... *gracillima* Taschenberg
—. Pronotum non strié en dessus, couvert d'une pubescence argentée étroitement appliquée ..... *producticollis* Morice
19. Segments apicaux de l'abdomen bleu vert avec un reflet métallique brillant 20

—. Segments apicaux de l'abdomen noirs ou ferrugineux, sans reflets métalliques 24
20. Clypéus court, son bord antérieur ne dépassant pas d'une façon sensible une ligne idéale joignant la base des yeux ..... *dubia* Kohl
—. Clypéus plus allongé, dépassant notablement une ligne idéale joignant la base des yeux 21
21. Pronotum anguleux sur les côtés ou en son milieu 22
—. Pronotum complètement arrondi 23
22. Pronotum de forme rectangulaire, ses angles saillants ..... *quadraticollis* Costa
—. Pronotum n'ayant pas les angles latéraux saillants, mais présentant un tubercule conique au milieu de son bord antérieur ..... *strumosa* Kohl
23. Bord antérieur du clypéus avec une petite échancrure semi-circulaire; mésopleures et mésosternum ponctués ..... *hemilauta* Kohl
—. Bord antérieur du clypéus non échancré; mésosternum et mésopleures striés ..... *nasuta* Lepeletier
24. Taille dépassant 25 mm.. Partie centrale des ailes jaune, rembrunie sur les bords ..... *egregia* Mocsary
—. Taille de moins de 25 mm.. Ailes presque incolores 25
25. Mésonotum ponctué, à striation presque invisible 26
—. Mésonotum présentant des stries transversales, plus ou moins ponctué entre les stries ..... *propinqua* Taschenberg
26. Clypéus assez court, son bord antérieur entier non échancré ..... *erminea* Kohl
—. Clypéus plus allongé, légèrement échancré en demi-cercle ..... *hemilauta* Kohl

Mâles

1. Ongles des tarses postérieurs présentant une ou deux dents à leur bord interne 2
—. Ongles des tarses postérieurs non dentés, ou n'ayant qu'une dent peu visible 7
2. Clypéus avec une carène médiane. Corps entièrement noir; ailes hyalines ..... *lateritia* Taschenberg
—. Clypéus non caréné 3
3. Ailes enfumées, avec des reflets bleus ou violacés; pattes brunes ..... *cyanipennis* Lepeletier
—. Ailes incolores 4
4. Partie médiane du mésosternum formant saillie en avant. Premier sternite deux fois plus long que le premier tergite ..... *dives* Brullé

—. Partie médiane du mésosternum ne faisant pas saillie en avant. Premier sternite égal ou seulement un peu plus long que le premier tergite 5

5. Mésonotum présentant deux tubercules caréniformes séparés par un sillon médian ..... *algira* Kohl

—. Mésonotum sans tubercules caréniformes 6

6. Clypéus légèrement déprimé en son milieu, son bord antérieur relevé et largement arrondi en avant ..... *lutea* Taschenberg

—. Clypéus non déprimé, plutôt bombé, rétréci en avant, son bord antérieur tronqué avec les angles latéraux saillants ..... *dolichostoma* nov.

7. Stigmates du premier segment abdominal situés au milieu ou très près du milieu du premier tergite, celui-ci plus ou moins dilaté (pétiole uni-articulé) 8

—. Stigmates du premier segment abdominal situés dans la moitié postérieure du premier tergite, celui-ci styliforme (pétiole bi-articulé) 13

8. Corps entièrement noir, sans reflets métalliques sur les derniers segments de l'abdomen 9

—. Corps en partie rouge, pouvant avoir les derniers segments de l'abdomen d'un bleu métallique 10

9. Aire dorsale du segment médiaire finement striée ; hanches antérieures dentées ..... *micipsa* Morice

—. Aire dorsale du segment médiaire chagrinée ; hanches antérieures non dentées ..... *Schmiedeknechti* nov.

10. Derniers segments de l'abdomen d'un bleu métallique brillant .... *atrocyanea* Eversmann et sa variété *massinissa* Morice

—. Derniers segments de l'abdomen noirs, sans reflets métalliques sensibles 11

11. Pattes antérieures jaunes, aussi les intermédiaires, en partie, et les écaillettes ..... *minax* nov.

—. Pattes et écaillettes noires 12

12. Ocelles plus rapprochés entre eux qu'ils ne sont distants des yeux. Pétiole plus long que le métatarse postérieur 13

—. Ocelles équidistants entre eux et avec les yeux. Pétiole de même longueur que le métatarse postérieur ..... *dispar* Taschenberg

13. Aire dorsale du segment médiaire chagrinée ..... *Tydei* Guillou

—. Aire dorsale du segment médiaire finement striée ..... *affinis* Kirby

14. Pronotum aussi large que long en son milieu 15

—. Pronotum transversal, plus large que long 16

15. Pronotum nettement silloné en travers, à pubescence très éparse .... *gricillima* Taschenberg

—. Pronotum non silloné, mais très finement ponctué, couvert d'une fine pubescence argentée, étroitement appliquée ..... *producticollis* nov.

16. Pronotum silloné en travers. Abdomen d'un bleu métallique à partir du troisième tergite ..... *haimatosoma* Kohl
—. Pronotum non silloné en travers. Troisième segment abdominal au moins en partie rouge 17
17. Clypéus rétréci en avant, échancré (sauf chez *strumosa* Kohl) ; dernier sternite échancré ou caréné 21
18. Derniers segments de l'abdomen bleus à reflets métalliques ..... *dubia* Kohl
—. Derniers segments de l'abdomen rouges ou noirs, sans reflets métalliques 19
19. Mésonotum ponctué ..... *erminea* Kohl
—. Mésonotum strié en travers, les stries peu visibles par suite d'une ponctuation surajoutée 20
20. Ailes jaunes. Côtés du pronotum striés. Taille dépassant 25 mm. ..... *egregia* Mocsary
—. Ailes hyalines. Côtés du pronotum non striés-ponctués. Taille inférieure à 23 mm. ..... *propinqua* Taschenberg
21. Dernier sternite non échancré, fortement caréné en toit. Clypéus échancré. Pronotum à angles latéraux saillants ..... *quadraticollis* Costa
—. Dernier sternite échancré, son bord postérieur non caréné 22
22. Bord antérieur du clypéus rétréci, tronqué mais non échancré. Pronotum avec les angles antérieurs marqués, et un tubercule médian prononcé au milieu du bord antérieur ..... *strumosa* Kohl
—. Clypéus à bord antérieur fortement rétréci et échancré 23
23. Mésonotum ponctué, vaguement strié. Clypéus allongé, à base cosvexe, extrémité avec une dépression circulaire, apex étroit et échancré. Abdomen presque entièrement rouge ..... *hemilauta* Kohl
—. Mésonotum nettement strié en travers. Clypéus allongé, son extrémité échancrée et carénée se relevant en une dent aiguë. Derniers segments de l'abdomen bleus à reflets métalliques ..... *nasuta* Lepeletier

REVUE DES ESPÈCES DU GENRE AMMOPHILA EXISTANT EN ÉGYPTE OU SIGNALÉES DE CE PAYS

1. Ammophila (Podalonia) atrocyanea Eversmann, 1849.
A. psilocera Kohl, ♂ [1888].

Femelle : Abdomen d'un beau bleu brillant, avec les ailes fortement rembrunies. Mésopleures ridées, à peine ponctuées.

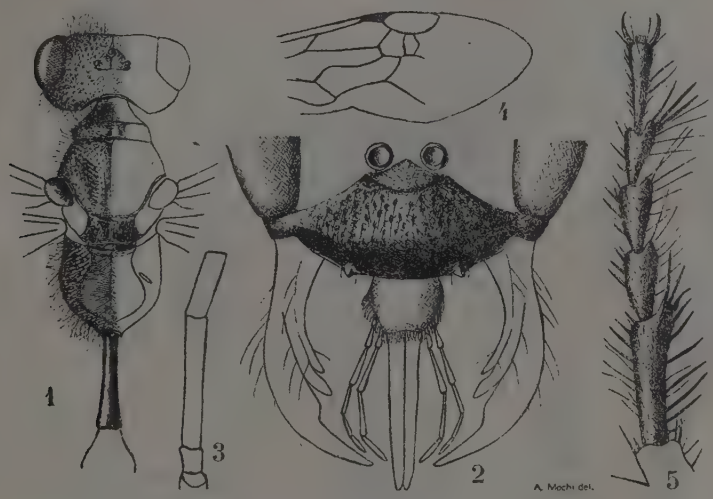
Mâle : Abdomen rouge, les derniers segments d'un bleu métallique brillant.

Longueur : ♂, 13-18 mm. ; ♀, 18-24 mm..

Egypte : Gebel Asfar, 17.3.1940 (une ♀, collection Alfieri).

Aire géographique : Oural, Turkestan, Altaï, Bakou, Algérie.

La variété *massinissa* Morice [1900] est plus petite (♂, 13-14 mm. ; ♀, 14-17 mm.), a les mésopleures obliquement striées et ponctuées entre les stries.



Ammophila (Podalonia) atrocyanea Eversmann (femelle)

Fig. 1 : Aspect général et sculpture. — Fig. 2 : Clypéus (var. *massinissa* Morice). — Fig. 3 : Premier article du funicule antennaire. — Fig. 4 : Aile antérieure (var. *massinissa* Morice). — Fig. 5 : Peigne du tarse antérieur.

Egypte : Sinaï (Wadi Um Mitla), 21.3.1937 (une ♀, collection Alfieri), et, de la même localité, 23.4.1938 (une ♀, collection Mochi).

Aire géographique : Décrite d'Algérie.

2. Ammophila (Podalonia) micipsa Morice, 1911.

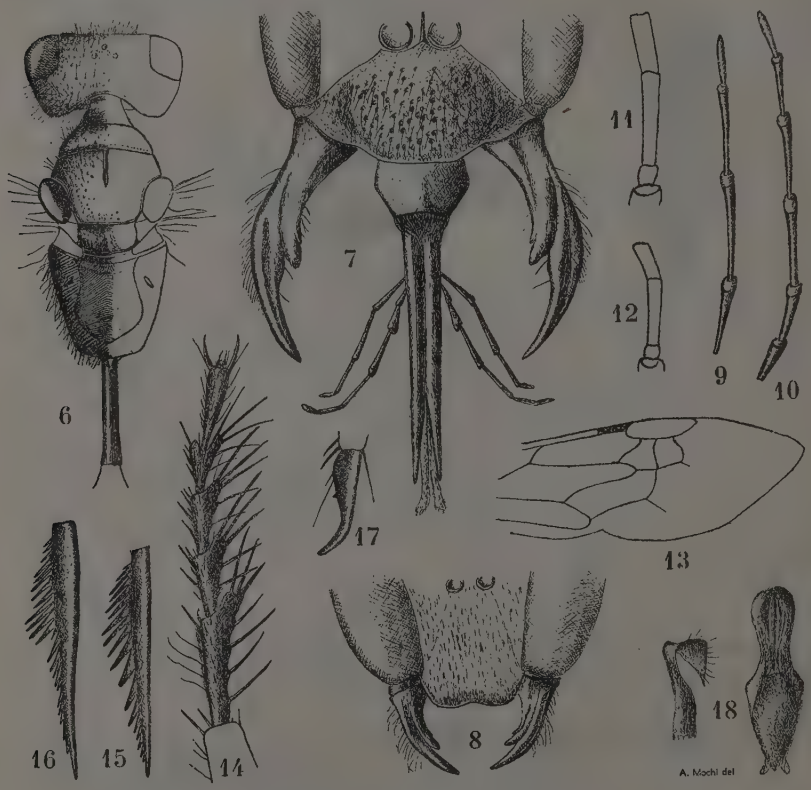
Femelle : Entièrement noire, avec les ailes obscurcies, et plus densément à l'apex. Pilosité noire, pas très dense. Mésonotum brillant, à ponctuation éparse ; aire dorsale du segment médiaire couverte de stries très fines et serrées, disposées un peu obliquement vers l'arrière. Une très petite dent au bord interne des tarses ; hanches antérieures portant, à leur extrémité inférieure, une apophyse plus ou moins aiguë.

Mâle : Semblable à la femelle ; les ailes plus claires, presque hyalines, rembrunies à l'apex ; les segments 2, 3 et 4 de l'abdomen couverts d'une pruinosité d'un blanc grisâtre.

Longueur : ♂, 15-18 mm. ; ♀, 16-20 mm..

Egypte : Gebel Asfar, Kafr Farouk, Marg, Ezbet Nakhlé, Abou Rouache, Sakkarah, Fayoum, commune en Février et Mars ; Wadi Hoff, en Juin ; Sinaï : Wadi Um Mitla, en Mars et Avril.

Aire géographique : Décrite d'Algérie, où elle serait très rare ; Syrie, Caucase, Turkestan.

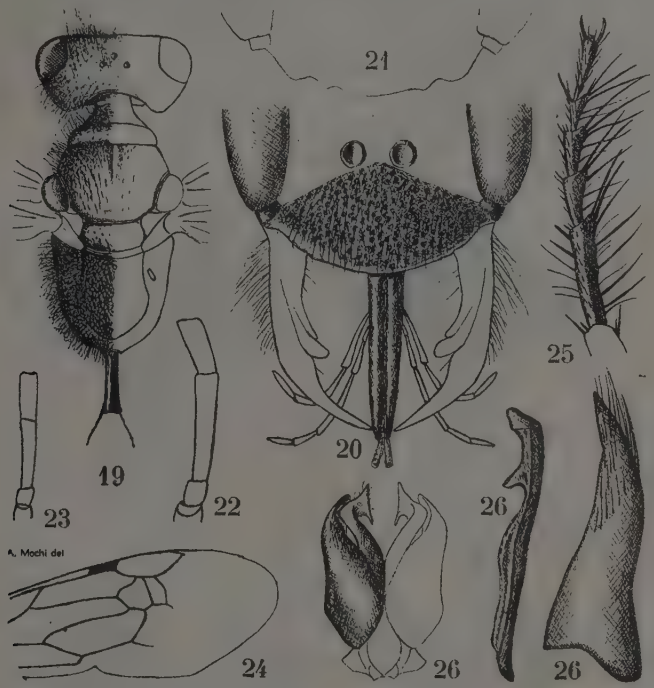


Ammophila (Podalonia) micipsa Morice

Fig. 6 : Aspect général et sculpture de la femelle. — Fig. 7 : Clypéus de la femelle. — Fig. 8 : Clypéus du mâle. — Fig. 9 : Palpe labial de la femelle. — Fig. 10 : Palpe maxillaire de la femelle. — Fig. 11 : Premier article du funicule antennaire de la femelle. — Fig. 12 : Premier article du funicule antennaire du mâle. — Fig. 13 : Aile antérieure. — Fig. 14 : Peigne du tarse antérieur de la femelle. — Fig. 15 : Eperon du tibia postérieur de la femelle. — Fig. 16 : Eperon du tibia postérieur du mâle. — Fig. 17 : Ongle du tarse postérieur. — Fig. 18 : Différentes pièces de l'armature génitale du mâle.

3. Ammophila (Podalonia) Schmiedeknechti Kohl, 1898.

Femelle : Entièrement noire, avec les ailes obscurcies ; chez certains spécimens, celles-ci ont un vague reflet violacé. Pilosité d'un brun foncé, plus



Ammophila (Podalonia) Schmiedeknechti Kohl

Fig. 19 : Aspect général et sculpture de la femelle. — Fig. 20 : Clypéus de la femelle. — Fig. 21 : Bord antérieur du clypéus du mâle. — Fig. 22 : Premier article du funicule antennaire de la femelle. — Fig. 23 : Premier article du funicule antennaire du mâle. — Fig. 24 : Aile antérieure. — Fig. 25 : Peigne du tarse antérieur de la femelle. — Fig. 26 : Différentes pièces de l'armature génitale du mâle.

dense que chez *micipsa* Morice. Mésonotum densément et assez fortement ponctué ; aire dorsale du segment médiaire chagrinée, à stries peu distinctes sauf un peu avant sur les côtés. Ongles des tarses non dentés ; hanches antérieures sans apophyse dentiforme. Asymétrie extérieure du métatarse antérieur peu prononcée. Pétiole plus court que chez *micipsa* Morice.

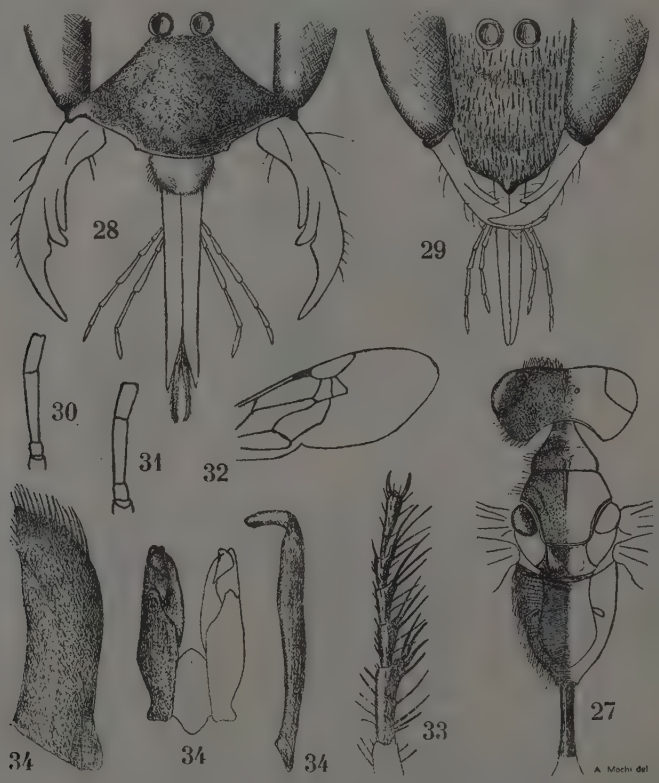
Mâle (*novum*) : Semblable à la femelle ; mésonotum moins densément ponctué, aire dorsale du segment médiaire à stries plus distinctes ; les segments 2, 3 et 4 de l'abdomen couverts d'une pruinosité d'un blanc-grisâtre plus prononcée que chez *micipsa*, surtout pour les deuxième et troisième segments.

Longueur : ♂, 14-16 mm. ; ♀, 15-18 mm..

Egypte : Gebel Asfar, Kafr Farouk, Ezbet Nakhlé, Abou Rouache, commune en Février et Mars ; Fayoum, en Octobre ; route de Suez(kilom. 94), en Mars et Novembre, assez commune ; Wadi Digla, en Avril ; Mariout : Ikinghi Mariout et Borg El-Arab, en Mars ; Sinaï : Wadi Um Mitla et Wadi Arbaein (Gebel Katherin), en Mars et Avril.

La femelle a été décrite du Wadi Hoff (Egypte) : le *type* du mâle (coll. Alfieri) provient de la Route de Suez (kilom. 94).

Aire géographique : Pas connue hors d'Egypte.



Ammophila (Podalonia) minax Kohl

Fig. 27 : Aspect général et sculpture de la femelle. — Fig. 28 : Clypéus de la femelle. — Fig. 29 : Clypéus du mâle. — Fig. 30 : Premier article du funicule antennaire de la femelle. — Fig. 31 : Premier article du funicule antennaire du mâle. — Fig. 32 : Aile antérieure. — Fig. 33 : Peigne du tarse antérieur de la femelle. — Fig. 34 : Différentes pièces de l'armature génitale du mâle.

4. Ammophila (Podalonia) minax Kohl, 1906.

Femelle : Noire, abdomen rouge avec les deux ou trois derniers segments noirs avec des reflets d'un bleu métallique ; les tibias et les tarses des pattes antérieures et intermédiaires, ainsi que plus ou moins l'extrémité des fémurs et les écaillettes d'un jaune-rougeâtre ; ailes sub-hyalines. Mésonotum peu ponctué, presque lisse ; aire dorsale du segment médiaire finement et densément striée. Hanches antérieures munies d'une apophyse dentiforme ; asymétrie des tarses antérieurs très nette ; pulvilli très petits.

Mâle (*novum*) : Coloration comme chez la femelle, les pattes plus largement jaunes, les reflets bleus métalliques moins vifs. Ailes sub-hyalines. Tête et thorax couverts d'une pubescence serrée, appliquée, d'un blanc-jaunâtre, masquant la sculpture des téguments sous-jacents ; sur le dessous de la tête, et sur les côtés du thorax, une pubescence blanche, assez longue et dressée. Aire dorsale du segment médiaire très finement striée. Les segments 1, 2, 3 et 4 de l'abdomen couverts de pruinosité blanche.

Longueur : ♂, 12-16 mm. ; ♀, 16-20 mm..

Egypte : Gebel Asfar, en Février ; Abou Rouache, Wadi Digla, en Avril et Mai ; Sinaï : Wadi Um Mitla, en Avril.

La femelle a été décrite du Caire (Abbassieh) ; le *type* du mâle (coll. Alfieri) a été capturé à Abou Rouache.

Aire géographique : Espèce connue seulement d'Egypte.

5. Ammophila (Podalonia) Tydei Guillou, 1841.

A. incana Dahlbom [1843], *Madeirae* Dahlbom [1843], *senilis* Dahlbom [1843], *canescens* Dahlbom [1843], *argentata* Lepeletier [1845], *Klugi* Lepeletier [1845], *capucina* Costa [1858].

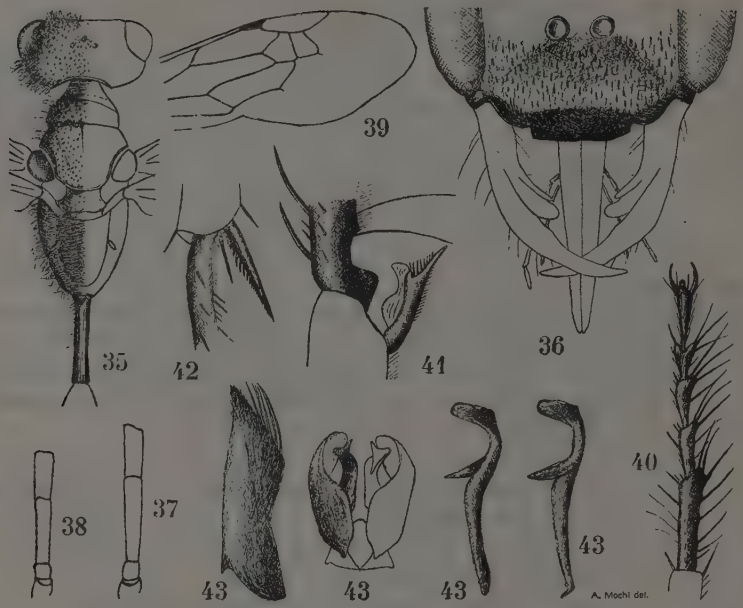
Femelle : Noire, abdomen plus ou moins rouge, pattes noires. Pilosité blanchâtre sur la tête et le thorax en entier, y compris le segment médiaire. Ailes presque incolores, les antérieures légèrement enfumées à l'apex. Mésonotum à ponctuation forte, confluente à l'avant. Aire dorsale du segment médiaire grossièrement sculptée. Pétiole à peu près aussi long que le métatarse postérieur. Asymétrie des tarses antérieurs peu marquée, visible au métatarse seulement ; pulvilli bien nets.

Mâle : Comme la femelle. Pétiole nettement plus long que le métatarse Ocelles plus rapprochés entre eux qu'ils ne sont distants des yeux.

Longueur : ♂, 12-20 mm. ; ♀, 16-21 mm..

Egypte : Marg, Ezbet Nakhlé, Kafr Farouk, Gebel Asfar, Ghizeh, Kerdacé, Abou Rouache, Massara, Abousir, Ikinghi Mariout, Siouf, Ismailia, Fayoum. Toute l'année, très commune en Avril et Mai.

Aire géographique : Europe méridionale, Syrie, Iran, Turkestan, Afrique du Nord, Madagascar.



Ammophila (Podalonia) Tydei Guillou

Fig. 35 : Aspect général et sculpture de la femelle. — Fig. 36 : Clypéus de la femelle. — Fig. 37 : Premier article du funicule antennaire de la femelle. — Fig. 38 : Premier article du funicule antennaire du mâle. — Fig. 39 : Aile antérieure. — Fig. 40 : Peigne du tarse antérieur de la femelle. — Fig. 41 : Eperon (appareil de toilette) du tibia antérieur. — Fig. 42 : Eperon du tibia postérieur. — Fig. 43 : Différentes pièces de l'armature génitale du mâle.

6. Ammophila (Podalonia) dispar Taschenberg, 1869.

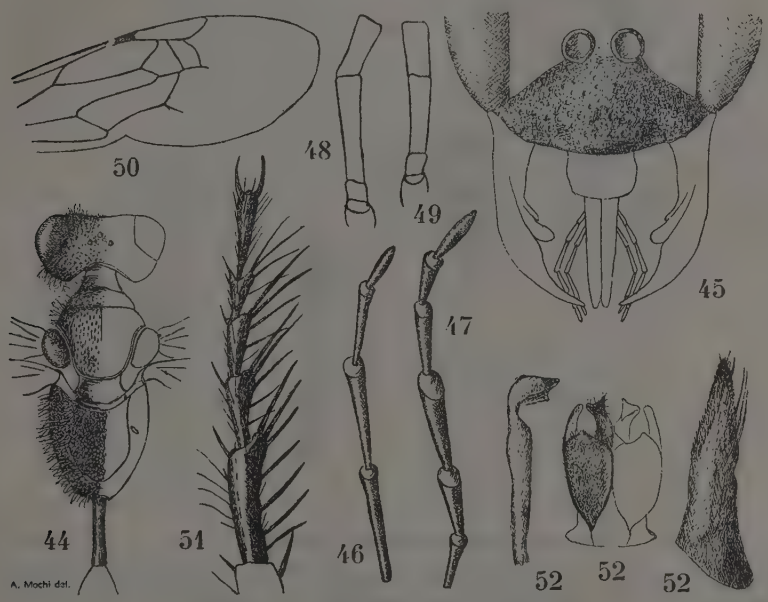
Femelle : Très semblable à la précédente. Noire, abdomen plus ou moins rouge, pattes noires. Pilosité noirâtre sur la tête et le thorax, d'un blanc-grisâtre sur le segment médiaire. Ailes antérieures enfumées, plus claires vers la base, ailes postérieures légèrement colorées. Mésonotum plus ou moins luisant, assez fortement ponctué, mais moins densément que chez l'espèce précédente. Aire dorsale du segment médiaire fortement chagrinée, avec assez souvent des apparences de stries. Pétiole beaucoup plus court que le métatarse postérieur (égalant environ les deux-tiers du métatarse). Asymétrie des tarses antérieurs limitée au métatarse avec, plus ou moins, le deuxième article des tarses ; pulvilli très petits, rudimentaires.

Mâle : Ne se distingue de celui de *Tydei* Guillou que par la longueur du pétiole égalant le métatarse postérieur, et par les ocelles équidistants entre eux et entre les yeux.

Longueur : ♂, 15-17 mm. ; ♀, 17-20 mm..

Egypte : Gebel Asfar, Kafr Farouk, Fayoum, assez répandue de Février à Mai, et en Décembre.

Aire géographique : Soudan (décrite de Khartoum).



Ammophila (Podalonia) dispar Taschenberg

Fig. 44 : Aspect général et sculpture de la femelle. — Fig. 45 : Clypéus de la femelle. — Fig. 46 : Palpe labial de la femelle. — Fig. 47 : Palpe maxillaire de la femelle. — Fig. 48 : Premier article du funicule antennaire de la femelle. — Fig. 49 : Premier article du funicule antennaire du mâle. — Fig. 50 : Aile antérieure. — Fig. 51 : Peigne du tarse antérieur de la femelle. — Fig. 52 : Différentes pièces de l'armature génitale du mâle.

7. Ammophila (Podalonia) affinis Kirby, 1798.

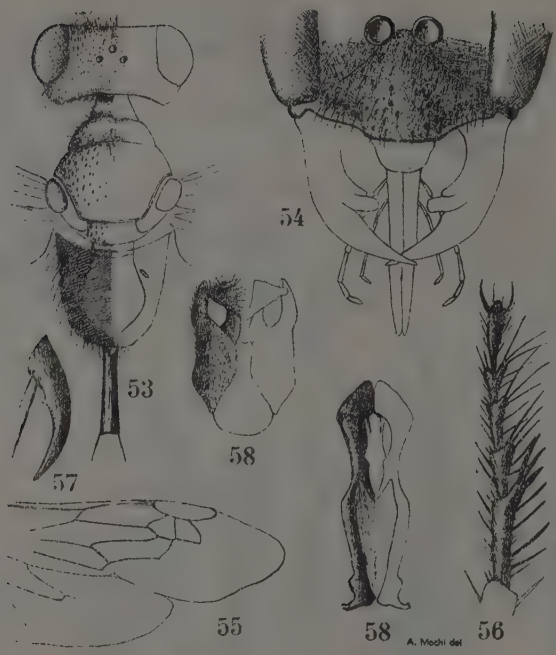
Femelle : Facies des deux espèces précédentes. Pulvilli développés, comme chez *Tydei* Guillou. Aire dorsale du segment médiaire finement et obliquement striée.

Mâle : Semblable à la femelle, moins trapu.

Longueur : ♂, 15-17 mm. ; ♀, 17-19 mm..

Egypte : Ezbet Nakhlé, Ein Shems, Borgash, Kerdacé, Abou Rouache, Nahia, de Février à fin Avril.

Aire géographique : Europe et Nord de l'Afrique.



Ammophila (Podalonia) affinis Kirby

Fig. 53 : Aspect général et sculpture de la femelle. — Fig. 54 : Clypéus de la femelle. — Fig. 55 : Ailes. — Fig. 56 : Peigne du tarse antérieur de la femelle. — Fig. 57 : Ongle du tarse postérieur. Fig. 58 : Différentes pièces de l'armature génitale du mâle.

8. Ammophila (Podalonia) ebenina Spinola, 1838.

Psammophila hirsuta Scopoli [1763] var. *mervensis* Radoszkowski, ♀ [1887].

La femelle a été décrite d'Egypte, mais n'a pas été retrouvée depuis, pas plus que le mâle. Si la synonymie *ebenina* = *mervensis* est exacte, ce qui est possible (*cf.* P. Roth, 1928), cette espèce (ou variété) se trouve un peu partout dans les régions voisines (Tunisie, Cyrénaique, Corse, Sardaigne, Crête, Syrie, Caucase et Turkestan).

Je ne connais pas cette forme ; en voici une description établie d'après les textes de Kohl et de Roth :

Femelle : Entièrement noire, sans reflets bleus métalliques ; les ailes obscurcies, plus foncées à leur extrémité. Tête et thorax à pilosité noire. Mésonotum à ponctuation dense et forte ; aire dorsale du segment médiaire chagrinée. Pulvilli des tarses rudimentaires.

Mâle : Semblable à la femelle ; mais dans certaines régions on trouverait des individus à abdomen noir et rouge, comme dans le type *hirsuta*.

Longueur : ♂, 12-21 mm. ; ♀ : 14-22 mm..

Ammophila (*Podalonia*) *hirsuta* Scopoli [1763], répandue dans tout le bassin méditerranéen, manque également en Egypte.

9. Ammophila (Parapsammophila) cyanipennis Lepeletier, 1845.

A. miles Taschenberg [1869].

Femelle : Noire, variée de brun-rouge sur la tête et le thorax ; pattes noires, en partie brunâtres. Pilosité d'un brun-noir. Ailes rembrunies, avec des reflets violets. Clypéus aplati, largement échancré en avant, les côtés de l'échancrure dentés. Bord antérieur du pronotum abrupt en avant. Mésonotum fortement rugueux, avec des indications de stries entremêlées de points ; mésopleures assez fortement ponctuées. Pétiole plus long que le métatarse postérieur. Asymétrie du métatarse et du deuxième article des tarses antérieurs très forte.

Mâle : D'allure générale semblable à la femelle. Clypéus aplati ; les articles 6 à 12 du funicule antennaire dilatés en dessous.

Longueur : ♂, 26-30 mm. ; ♀, 30-36 mm..

Kohl a figuré l'aile et le tarse antérieurs de la femelle, ainsi que la spathe du mâle.

Egypte : Indiquée par Kohl, sans référence spéciale.

Aire géographique : Décrit du Sénégal ; Soudan égyptien.

10. Ammophila (Parapsammophila) lateritia Taschenberg, 1869.

A. monilicornis Morice [1900].

Femelle : Noire, variée de brun-rouge sur la tête, le thorax et les pattes. Pilosité brune. Ailes sub-hyalines. Clypéus tronqué, non échancré, les côtés de la troncature non dentés. Mésonotum strié en travers dans sa partie antérieure, et longitudinalement en arrière ; pleurs striées-ponctuées. Pétiole plus long que le métatarse. Asymétrie des tarses antérieurs forte. Roth a figugré l'ongle de la patte postérieure de la femelle.

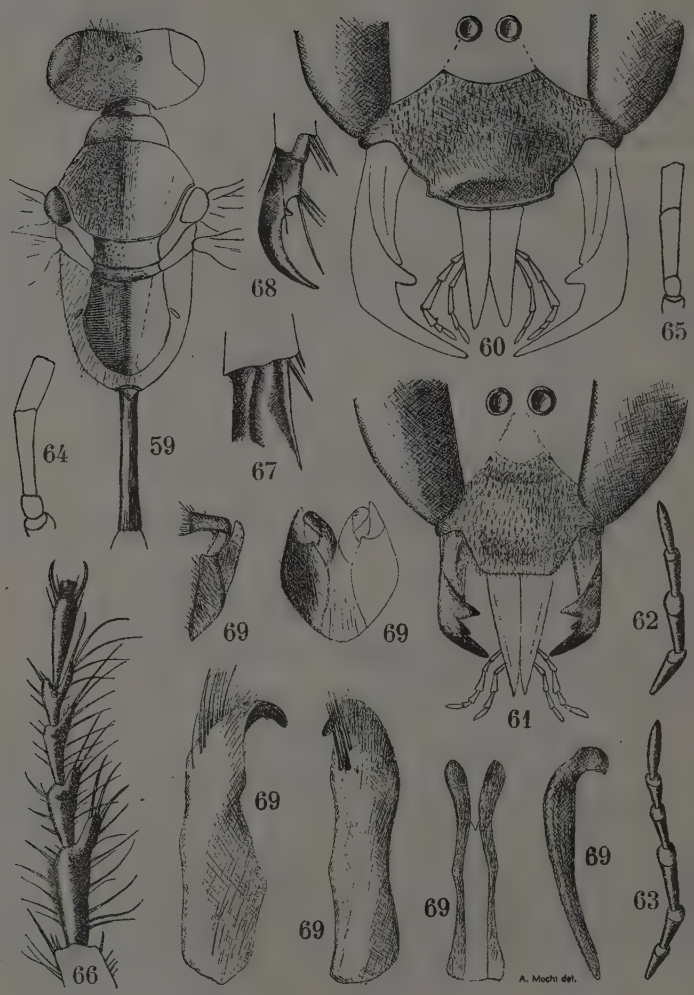
Mâle : Complètement noir (toujours ?). Pilosité grisâtre. Ailes subhyalines. Clypéus caréné dans sa partie médiane, renflé en avant ; articles 6 à 12 du funicule des antennes dilatés en dessous comme chez *cyanipennis* Lepeletier. Sculpture du thorax comme chez la femelle.

Longueur : ♂, 17 mm. ; ♀, 25-30 mm.

Egypte : Indiquée de Maadi (*monilicornis* Morice) en Mai (Storey : *Bull. Soc. Entom. Egypte*, IV, 1914-1915 [1916], p. 107).

Aire géographique : Nord de l'Afrique (Algérie) et Soudan

D'après les constatations de P. Roth [1928], la réunion de *lateritia* Taschenberg (♀) et de *monilicornis* Morice (♂) peut être considérée comme un fait acquis.



Ammophila (Eremochares) lutea Taschenberg

Fig. 59 : Aspect général et sculpture de la femelle. — Fig. 60 : Clypéus de la femelle — Fig. 61 : Clypéus du mâle. — Fig. 62 : Palpe labial de la femelle. — Fig. 63 : Palpe maxillaire de la femelle. — Fig. 64 : Premier article du funicule antennaire de la femelle. — Fig. 65 : Premier article du funicule antennaire du mâle. — Fig. 66 : Peigne du tarse antérieur de la femelle. — Fig. 67 : Eperon du tibia postérieur. — Fig. 68 : Ongle du tarse postérieur. — Fig. 69 : Différentes pièces de l'armature génitale du mâle.

11. Ammophila (Eremochares) lutea Taschenberg, 1869.

Femelle : Tête, thorax et le premier article du pétiole noirs ; le clypéus, le scape des antennes, les écaillettes et les pattes de l'abdomen sont d'un rouge-orangé clair. Ailes hyalines, à nervures d'un jaune-orangé. Thorax couvert d'une pilosité blanche, appliquée, qui manque sur le mésonotum, le scutellum, et sur un dessin à contour lyriforme sur l'aire dorsale du segment médiaire. Clypéus tronqué arrondi, le bord antérieur précédé de deux petites bosses. Mésonotum ponctué, pleures ponctuées-ridées. Partie médiane du mésosternum arrondie, non prolongée en éperon comme chez *dives* Brullé. Asymétrie externe du métatarse et du deuxième article des tarses antérieurs très prononcée. Hanches antérieures avec un tubercule dentiforme. Pétiole plus long que le métatarse postérieur, égalant le métatarse plus la moitié du deuxième article du tarse.

Mâle : Semblable à la femelle. Yeux convergents vers le clypéus, celui-ci allongé, aplati, en forme de selle, relevé à son bord antérieur. Pétiole égalant les deux premiers articles des tarses postérieurs.

Longueur : ♂, 20-28 mm. ; ♀, 26-30 mm..

Egypte : Fayoum, Abou Rouache, Gebel Asfar. Pas rare en Avril et Mai.

Aire géographique : Soudan égyptien, Nord de l'Afrique, Transcaspie, Iran.

12. Ammophila (Eremochares) algira Kohl, 1901.

Femelle : Noire ; abdomen d'un rouge sombre, noir à l'extrémité. Pattes noires, les tarses d'un brun plus ou moins clair. Ailes hyalines. Pilosité sur le thorax, blanche, peu fournie. Asymétrie des tarses antérieurs très marquée. Ressemble beaucoup à *lutea* Taschenberg, dont elle diffère par la partie médiane du mésosternum non arrondie, mais légèrement proéminente en un angle droit, sans toutefois en arriver à la formation d'un éperon comme chez *dives* Brullé. Clypéus à bord antérieur relevé, avec les angles latéraux un peu saillants.

Mâle : D'après Roth, serait semblable à la femelle comme coloration, et comme pilosité.

Serait caractérisée surtout par un « Dorsulum présentant deux gibbosités coniformes séparées par un sillon médian. Le scutum offre ainsi un aspect bituberculé très caractéristique qui, à ma connaissance, ne trouve son analogue chez aucune autre Ammophile ».

Longueur : ♂, 18 mm. (Roth indique comme longueur pour le mâle qu'il décrit sur un spécimen unique : 8 mm.. Est-ce une erreur typographique ? Sinon, il y aurait là un cas de nanisme remarquable, qui pour-

rait peut-être expliquer le caractère très spécial du dessus du thorax) ; ♀, 20-23 mm.

Roth a figuré le mésosternum de cette espèce, vu de profil, ainsi que l'ongle du tarse postérieur de la femelle. L'aile de la femelle est figurée par Kohl.

Egypte : Pas connue de ce pays.

Aire géographique : Décrite d'Algérie, inconnue d'ailleurs.

Cette espèce est mentionnée ici surtout en raison de ce que Kohl a décrit du Fayoum une espèce (*caelebs*) dont il ne connaît que le mâle, et qu'il considère comme pouvant être le mâle de son *algira ;* mois le *caelebs* de Kohl étant bien différent de *algira* mâle décrit par Roth, il serait intéressant de retrouver le *caelebs* et la femelle correspondante.

13. Ammophila (Eremochares) caelebs Kohl, 1906.

Description d'après Kohl :

Mâle : Voisin de *lutea* Taschenberg. Corps noir, la moitié postérieure de la seconde partie du pétiole et les deux segments suivants rouges, pattes noires. Ailes jaunâtres. Pilosité blanche, longue et fournie sur la tête et le thorax, avec, sur les pleures, une pubescence sous-ajacente d'un blanc pur, insuffisante pour cacher la sculpture des téguments ; clypéus avec une pubescence blanche feutrée. Clypéus aplati, non creusé en forme de selle comme chez *lutea,* les bords un peu relevés en avant. Face assez étroite, les bords internes des yeux convergents vers le bas ; ocelles équidistants entre eux et d'avec les yeux. Pronotum tombant presque perpendiculairement en avant, mais avec le bord antérieur non anguleux, plutôt arrondi. Dorsulum couvert de stries rugueuses transversales en avant, luisant en son milieu et éparsement ponctué. Scutellum convexe, ponctué. Pleures et mésosternum à ponctuation coriacée ; suture épisternale bien développée ; mésosternum non prolongé en cône. Segment médiaire avec de fortes stries obliques entremêlées de points. Première partie du pétiole pas beaucoup plus longue que la seconde, égalant le métatarse et le deuxième article des tarses postérieurs pris ensemble. Plaque anale dorsale arrondie, les cinquième et sixième plaques ventrales échancrées au milieu du bord postérieur. Hanches antérieures non dentées. Troisième cellule cubitale plus rétrécie sur la nervure radiale que sur la nervure cubitale, recevant la deuxième nervure récurrente (peut-être pas toujours). L'aile est figurée par Kohl.

Longueur : ♂, 18 mm..

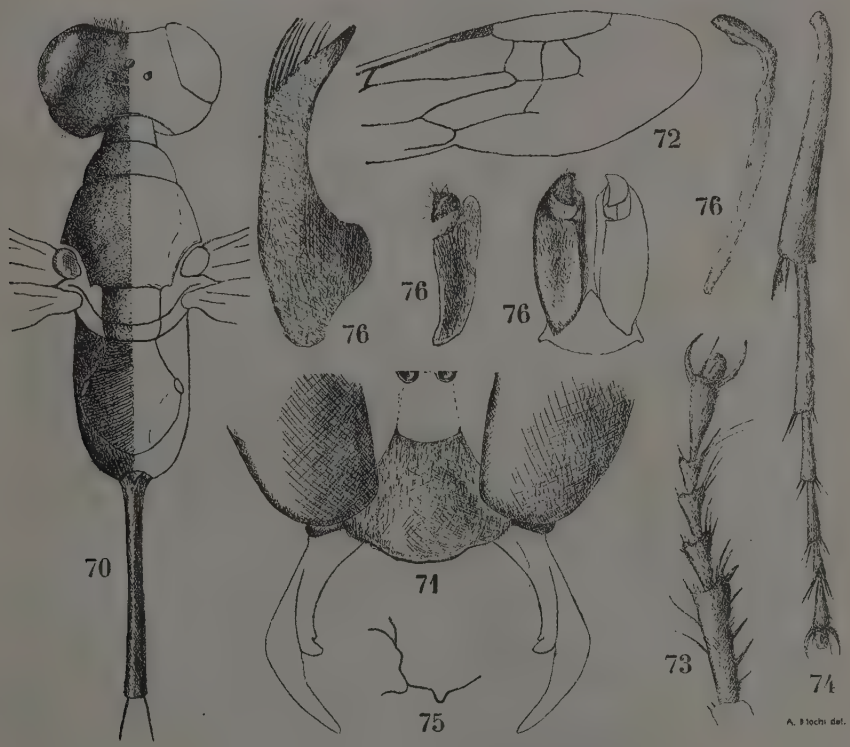
Egypte : Décrit du Fayoum, sur un exemplaire. Non retrouvé depuis.

Femelle inconnue.

14. Ammophila (Eremochares) dives Brullé, 1832.

Ammophila lutea Taschenberg [1869] (♂, non ♀), *nigritaria* Walker [1871], *Doriae* Gribodo [1882].

Femelle : Mandidules et clypéus rougeâtres ; premier et deuxième tergites rouges, le troisième rouge et noir ; pattes antérieures et intermédiaires rouges, les postérieures noir-brunâtre. Ailes hyalines. Pubescence blanche sur la tête et le thorax, étroitement appliquée sur la face, le dessous du thorax en entier et sur les hanches antérieures. Mésonotum ponctué, la ponctuation confluente et coriacée ; scutellum et post-scutellum densément ponctués ; aire dorsale du segment médiaire densément striée, striation dif-



Ammophila (Eremochares) dives Brullé

Fig. 70 : Aspect général et sculpture de la femelle. — Fig. 71 : Clypéus de la femelle. — Fig. 72 : Aile antérieure. — Fig. 73 : Peigne du tarse antérieur de la femelle. — Fig. 74 : Tibia et tarse postérieur de la femelle. — Fig. 75 : Prosternum de la femllle, vu de profil. — Fig. 76 : Différentes pièces de l'armature génitale du mâle (d'après des exemplaires provenant de Marrakech, Maroc).

fuse sur le milieu de l'aire, plus nette sur les côtés. Partie médiane du mésosternum dilatée en avant au point de présenter un cône nettement proéminent en soc de charrue, caractère qui permet de distinguer *dives* d'entre toutes les autres espèces paléarctiques. Pétiole plus long que le métatarse postérieur. Asymétrie du métatarse antérieur à peu près nulle.

Il est à remarquer que la coloration ci-dessus est la plus fréquente, et c'est celle des trois exemplaires que nous ayons sous les yeux ; mais, dans certaines régions, l'abdomen peut être presque complètement clair ou presque entièrement noir.

Mâle : Coloration et saillie antérieure du mésosternum comme chez la femelle.

Longueur : ♂, 20-24 mm. ; ♀, 25-30 mm..

Egypte : Trois femelles capturées au Mariout (Ikinghi-Mariout, Borg El-Arab et Hammam), en Juin et Juillet.

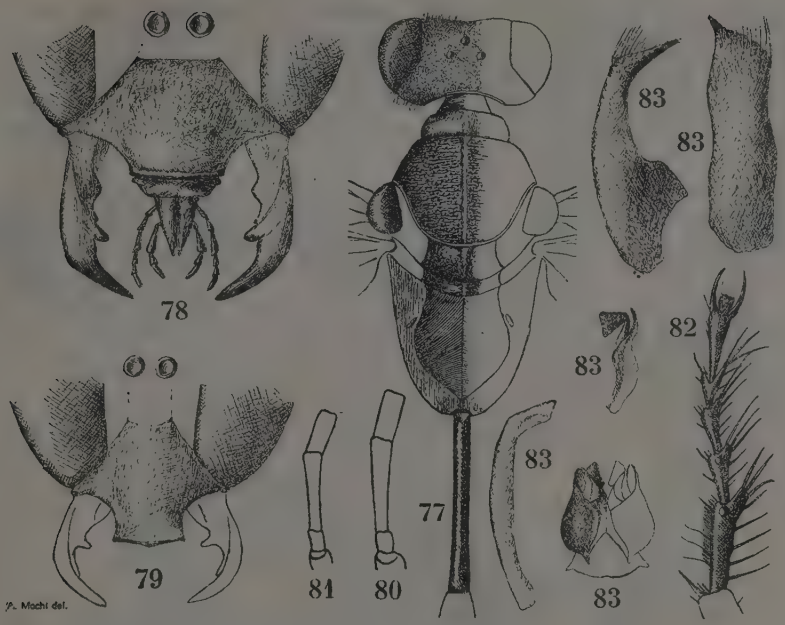
Aire géographique : Nord de l'Afrique, Arabie, Asie Mineure, Balkans.

Une variété (*festiva* Smith [1856], ♀ = *Doriae* Gribodo [1882]), à abdomen entièrement rouge, a été décrite de Tunisie.

Le mâle de *dives* n'a pas encore été trouvé en Egypte.

15. Ammophila (Eremochares) dolichostoma Kohl, 1908.

Femelle : Noire ; mandibules et clypéus jaunes ; le scape des antennes, les écaillettes et les pattes en grande partie rougeâtres ; l'abdomen également rouge, à part le dessus du premier article du pétiole et les derniers segments qui sont noirs, sans reflets métalliques. Ailes légèrement teintées. Pilosité blanche, dense, feutrée sur la tête et le thorax, mais laissant à découvert le mésonotum et l'aire dorsale du segment médiaire. Pronotum arrondi, presque sans points ; mésonotum strié transversalement dans sa partie antérieure avec des points dans les stries et sur les côtés du mésonotum, celui-ci moins ponctué en arrière, presque lisse en son milieu ; scutellum avec un large sillon médian déterminant deux bosses luisantes. Pleures ponctuées. Aire dorsale du segment médiaire nue, creusée d'une gouttière peu profonde avec une fine ligne médiane relevée en crête, la surface de l'aire couverte de stries fines et serrées, disposées obliquement vers l'arrière de part et d'autre de la ligne médiane. Suture épisternale bien visible ; partie médiane du mésosternum quelque peu dilatée en angle droit, sans toutefois en arriver à une proéminence bien marquée connue chez *dives* Brullé. Premier article du pétiole aussi long que les deux premiers articles des tarses postérieurs. Asymétrie du métatarse antérieur très marquée, les articles suivants du tarse à peu près normaux. Hanches antérieures avec un cône dentiforme peu marqué.



Ammophila (Eremochares) dolichostoma Kohl

Fig. 77 : Aspect général et sculpture de la femelle. — Fig. 78 : Clypéus de la femelle. — Fig. 79 : Clypéus du mâle. — Fig. 80 : Premier article du funicule antennaire de la femelle. — Fig. 81 : Premier article du funicule antennaire du mâle. — Fig. 82 : Peigne du tarse antérieur de la femelle. — Fig. 83 : Différentes pièces de l'armature génitale du mâle.

Mâle (*novum*) : Coloration semblable à celle de la femelle, le noir de l'abdomen plus étendu, le dessus de tous les arceaux plus ou moins noir. Yeux nettement convergents vers le bas de la face. Clypéus plus allongé que chez la femelle, les angles de la troncature plus marqués. Abdomen couvert d'une pruinosité bleuâtre. Le *type* du mâle provient du Wadi Digla, 14.5.1927 (coll. Alfieri).

Longueur : ♂, 18-22 mm. ; ♀, 22-25 mm..

Egypte : Abou Rouache, Wadi Digla, Wadi Hoff, en Avril, Mai et Juillet ; Sinaï : Wadi Um Mitla, en Avril et Mai.

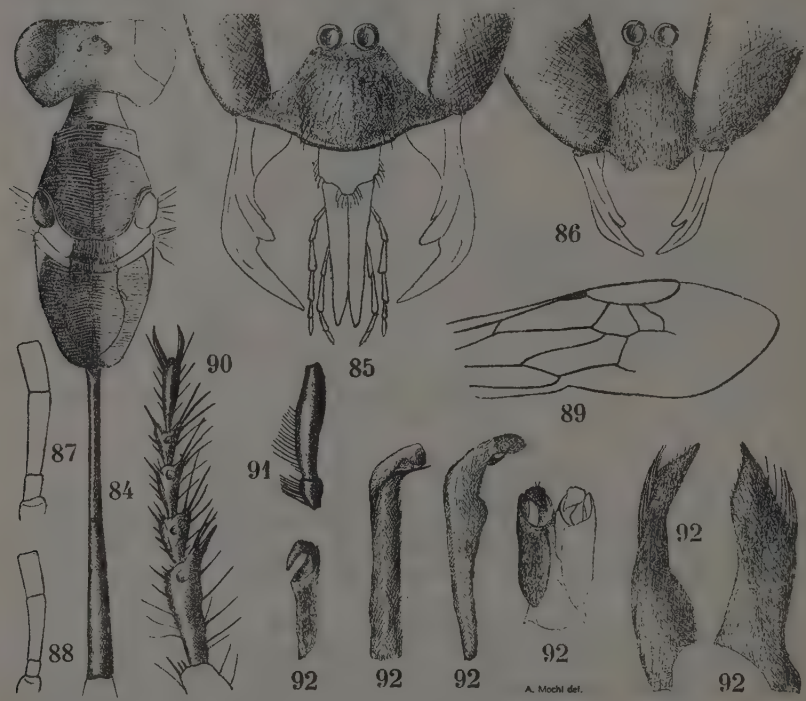
Aire géographique : Décrit d'Aden (Arabie).

16. Ammophila (s. str.) haimatosoma Kohl, 1883.

Femelle : Tête, prothorax, pattes et tiers antérieur du deuxième segment de l'abdomen d'un rouge plus ou moins foncé ; mésonotum et segment médiaire d'un brun-rouge très foncé, paraissant noir ; antennes brun-

rouge, à base plus claire; derniers arceaux de l'abdomen noirs, avec un reflet bleu métallique très net, et couverts d'une pruinosité très fugace.

Cette coloration est celle des exemplaires d'Egypte et du Sinaï, que l'on peut considérer comme particulièrement foncés. Vers l'Ouest, en Algérie par exemple, le thorax serait, d'après Roth, beaucoup plus largement



Ammophila (s. str.) haimatosoma Kohl

Fig. 84 : Aspect général et sculpture de la femelle. — Fig. 85 : Clypéus de la femelle. — Fig. 86 : Clypéus du mâle. — Fig. 87 : Premier article du funicule antennaire de la femelle. — Fig. 88 : Premier article du funicule antennaire du mâle. — Fig. 89 : Aile antérieure. — Fig. 90 : Peigne du tarse antérieur de la femelle. — Fig. 91 : Hanche et fémur antérieur de la femelle. — Fig. 92 : Différentes pièces de l'armature génitale du mâle.

rouge, ou mêne entièrement rouge; il y a aussi plus de rouge à l'abdomen. A cette coloration correspond une femelle du Sinaï (Wadi El-Ghedeirat, 24-25.5.1935) que je nomme variété *sinaitica* nov. (Type collection Alfieri).

Ailes jaunâtres. Pilosité du corps clairsemée.

Yeux parallèlles, face large, clypéus court. Pronotum profondément silloné en travers; le mésonotum également, mais les rides sont moins pro-

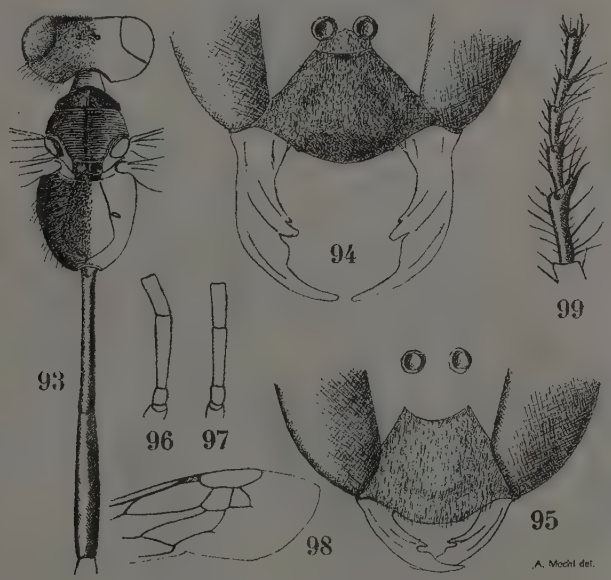
noncées ; scutellum et postscutellum portant des stries longitudinales Aire dorsale du segment médiaire densément striée, les stries disposées obliquement vers l'arrière, plus nettes sur les côtés. Premier article du péticle un peu plus court que les deux premiers articles des tarses postérieurs pris ensemble. Pulvilli absents.

Mâle : Coloration plus foncée que chez la femelle, le rouge du thorax a presque entièrement disparu. Ailes à peine jaunâtres. Tête et thorax couverts par une fine pubescence serrée.

Longueur : ♂, 14-20 mm. ; ♀, 20-25 mm..

Egypte : Gebel Asfar, Abou Rouache, Fayoum, Abou Sultan, Route de Suez (kilom. 94), d'Avril à Juillet et de Septembre à Novembre ; Sinai : Wadi El-Gheiderat, en Mai.

Aire géographique : Algérie, Tunisie, Syrie, et Chypre d'où il est décrit.



Ammophila (s. str.) dubia Kohl

Fig. 93 : Aspect général et sculpture de la femelle. — Fig. 94 : Clypéus de la femelle. — Fig. 95 : Clypéus du mâle. — Fig. 96 : Premier article du funicule antennaire de la femelle. — Fig. 97 : Premier article du funicule antennaire du mâle. — Fig. 98 : Aile antérieure. — Fig. 99 : Peigne du tarse antérieur de la femelle.

17. Ammophila (s. str.) dubia Kohl, 1906.

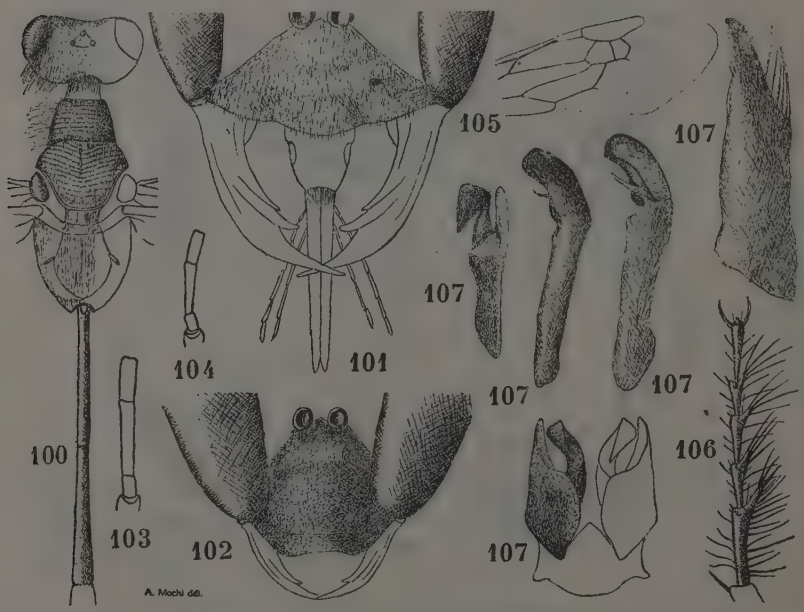
Femelle : Noire; mandibules, pattes et écaillettes rouges; abdomen également rouge, exception faite des trois derniers segments qui sont d'un bleu métallique brillant, plus ou moins recouverts par une pruinosité argentée. Tête et thorax couverts d'une fine pubescence feutrée. Ailes subhyalines. Pronotum ponctué; mesonotum finement strié en travers, scutellum strié longitudinalement; aire dorsale du segment médiaire rugueuse, confusément striée. Asymétrie du métatarse antérieur médiocre.

Mâle : Coloration, pubescence et sculpture comme chez la femelle. Yeux convergents vers le bas.

Longueur : ♂, 15-20 mm.; ♀, 16-22 mm.

Egypte : Gebel Asfar, Kafr Farouk, Méadi, Wasta et Fayoum, de Février à Novembre.

Aire géographique : Décrit de Malte.



Ammophila (s. str.) gracillima Taschenberg

Fig. 100 : Aspect général et sculpture de la femelle. — Fig. 101 : Clypéus de la femelle. — Fig. 102 : Clypéus du mâle. — Fig. 103 : Premier article du funicule antennaire de la femelle. — Fig. 104 : Premier article du funicule antennaire du mâle. — Fig. 105 : Aile antérieure. — Fig. 106 : Peigne du tarse antérieur de la femelle. — Fig. 107 : Différentes pièces de l'armature génitale du mâle.

18. Ammophila (s. str.) gracillima Taschenberg, 1869.

Femelle : Tête et thorax noirs ; abdomen rouge, moins les trois derniers segments qui sont d'un noir brillant, avec un très léger reflet métallique. Tête et thorax couverts d'une pubescence couchée, d'un blanc-grisâtre, très serrée. Ailes sub-hyalines. Pronotum plus long que large, nettement strié en travers ; mésonotum également ridé ; scutellum et postscutellum relevés tous deux en bosse plus ou moins bifide. Aire dorsale du segment médiaire finement rugueuse, cette sculpture peu visible par suite de la pubescence feutrée très dense qui recouvre tout le thorax.

La forme spéciale du pronotum suffit à caractériser très bien cette espèce. Un autre caractère excellent, mais difficile à constater, se trouve dans l'articulation toute particulière des hanches antérieures dans une découpure profonde du sternum.

Mâle : Très semblable à la femelle, beaucoup plus grêle.

Longueur : ♂, 14-16 mm., ♀, 16-20 mm.

Egypte : Gebel Asfar, Kafr Farouk, Wadi Digla, d'Avril à Juillet et en Octobre ; Sinaï : Wadi Um Mitla, en Avril.

Aire géographique : Abyssinie, Nubie, Afrique du Nord.

19. Ammophila (s. str.) producticollis Morice, 1900.
A. divina Kohl [1906].

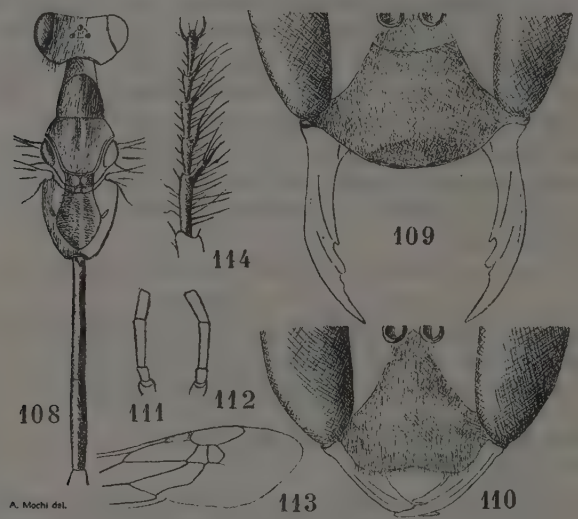
Femelle : Noire ; mandibules, clypéus, scape, pattes, abdomen, moins les deux derniers segments, rouge clair ; extrémité de l'abdomen noire en dessus, avec de vagues reflets verts. Ailes hyalines. Tête, thorax en entier, fémurs et la majeure partie de l'abdomen recouverts étroitement d'une fine pubescence argentée masquant la sculpture des téguments. Pronotum allongé, plus long que large, comme chez *gracillima* Taschenberg, mais non strié en travers, très finement ponctué. Sculpture du thorax pratiquement invisible. Asymétrie des tarses antérieurs très marquée, s'étendant aux quatre articles du tarse. Aspect général très grêle.

Mâle : (*novum*) : Coloration semblable à celle de la femelle, mieux visible, ainsi que la sculpture du thorax, le revêtement de pubescence argentée en étant moins dense ; aspect général encore plus grêle que celui de la femelle. Yeux convergents vers le bas. Clypéus creusé en son milieu, relevé à son bord antérieur et largement échancré. Pronotum allongé, très finement ponctué ; mésonotum avec des stries transversales peu marquées, le scutellum et le postscutellum ridés, l'aire médiane du segment médiaire striée d'une manière un peu diffuse ; tout ceci plus ou moins visible suivant la densité de la pubescence ; la sculpture du dessous du thorax est invisible par suite de la pubescence qui le recouvre. Extrémité plus largement et plus nettement bleue que chez la femelle.

Le *type* du mâle (coll. Alfieri) a 18 mm. de longueur. Il provient du Wadi Hoff, 10.10.1919.

Longueur : ♂, 15-18 mm.; ♀, 13-20 mm..

Egypte : Gebel Asfar, Abou Rouache, Wadi Hoff, Avril-Juin et Oc-



Ammophila (s. str.) producticollis Morice

Fig. 108 : Aspect général et sculpture de la femelle. — Fig. 109 : Clypéus de la femelle. — Fig. 110 : Clypéus du mâle. — Fig. 111 : Premier article du funicule antennaire de la femelle. — Fig. 112 : Premier article du funicule antennaire du mâle. — Fig. 113 : Aile antérieure. — Fig. 114 : Peigne du tarse antérieur de la femelle.

tobre; Sinaï : Wadi Um Mitla et Wadi El-Ghederat, en Avril et Mai. Plutôt rare.

Aire géographique : Algérie (femelle décrite de Biskra), Tozeur.

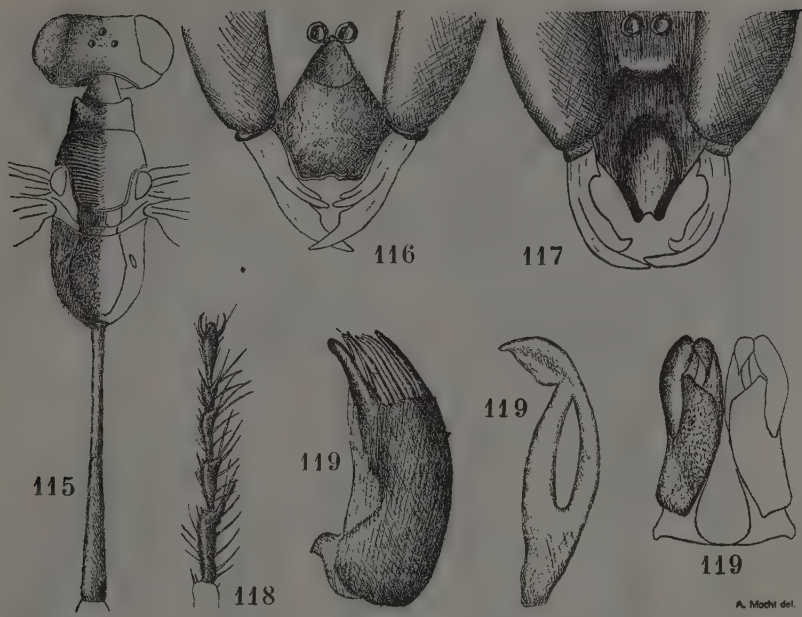
20. Ammophila (s. str.) quadraticollis Costa, 1893.

Cette remarquable espèce est caractérisée par son pronotum rectangulaire à angles latéraux saillants.

Kohl a figuré le pronotum de la femelle, le sternite terminal du mâle, ainsi que la tête et le premier article du funicule antennaire des deux sexes.

Egypte : Ras El-Bar, en Juillet, une femelle (coll. Alfieri), et Sinaï (El-Arish, en Juin), un mâle (coll. Alfieri).

Aire géographique : Décrite de Tunisie; Algérie, Cyrénaïque, Tripolitaine.



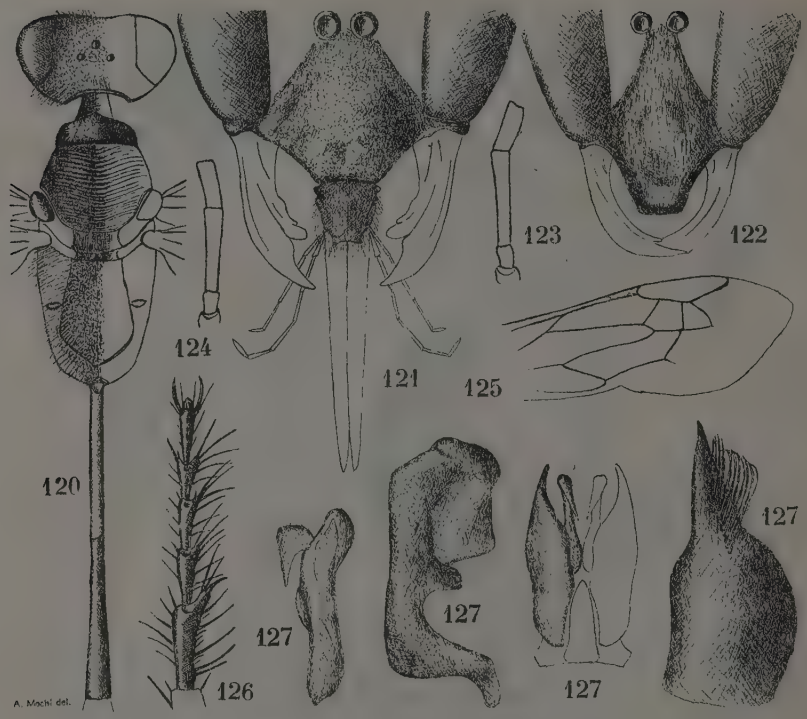
Ammophila (s. str.) quadraticollis Costa

Fig. 115 : Aspect général et sculpture de la femelle. — Fig. 116 : Clypéus de la femelle. — Fig. 117 : Clypéus du mâle. — Fig. 118 : Peigne du tarse antérieur de la femelle. — Fig. 119 : Différentes pièces de l'armature génitale du mâle.

21. Ammophila (s. str.) strumosa Kohl, 1906.

A. quadraticollis var. ♀ Kohl [1906].

Femelle : Noire ; pattes antérieures et intermédiaires, et plus ou moins les tibias postérieurs rouges ; est rouge également l'abdomen, sauf le premier article du pétiole qui est noir, et les deux dernriers segments de l'abdomen qui sont bleus à reflets brillants. Ailes hyalines. Pubescence médiocre, plus fine et serrée sur le dessous du thorax et sur le segment médiaire en entier. Pronotum peu ponctué, présentant, au milieu de son bord antérieur, un tubercule saillant ; côtés du pronotum à angles non saillants, caractère qui distingue *strumosa* Kohl de *quadraticollis* Costa ; mésonotum densément strié en travers ; aire dorsale du segment médiaire couverte de stries assez fines disposées obliquement. Asymétrie du métatarse antérieur assez marquée, moindre sur le deuxième article du tarse, nulle sur les articles suivants.



Ammophila (s. str.) strumosa Kohl

Fig. 120 : Aspect général et sculpture de la femelle. — Fig. 121 : Clypéus de la femelle. — Fig. 122 : Clypéus du mâle. — Fig. 123 : Premier article du funicule antennaire de la femelle. — Fig. 124 : Premier article du funicule antennaire du mâle. — Fig. 125 : Aile antérieure. — Fig. 126 : Peigne du tarse antérieur de la femelle. — Fig. 127 : Différentes pièces de l'armature génitale du mâle.

Mâle (décrit par Roth en 1928) : Coloration et pubescence comme chez la femelle. Clypéus très allongé, tronqué à son bord antérieur, mais non échancré. Plaque sternale anale échancrée à son bord postérieur.

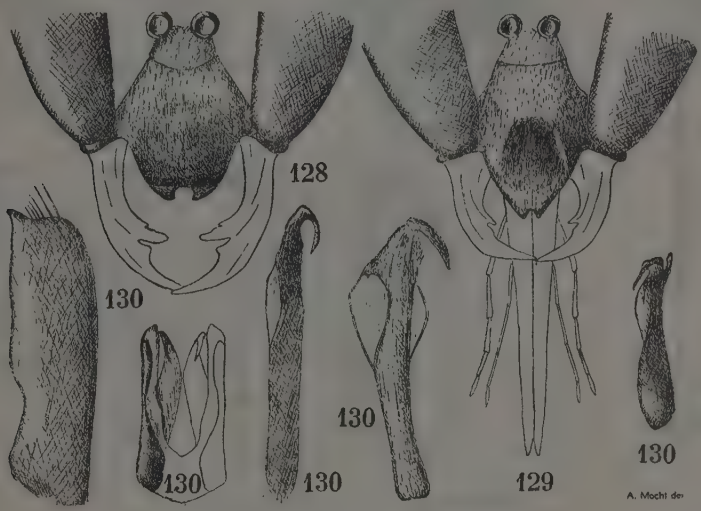
Longueur : ♂, 19-22 mm. ; ♀, 20-24 mm..

Egypte : Kafr Farouk, Route de Suez (8e Tour), Meadi, Wadi Um Elek, Wadi Um Assad, de Mars à Mai ; Sinaï : Wadi Um Mitla, en Mai. Plutôt rare.

Aire géographique : Décrit de Syrie ; Nord de l'Afrique.

22. Ammophila (s. str.) hemilauta Kohl, 1906.

Femelle : Noire; mandibules, écaillettes, pattes en partie, rouges; abdomen rouge, moins le premier article du pétiole qui est noir, et les deux derniers arceaux qui sont bleu-noirs avec un reflet métallique plus ou moins visible. Ailes hyalines. Pubescence assez dense sur la tête et le



Ammophila (s. str.) hemilauta Kohl

Fig. 128 : Clypéus de la femelle. — Fig. 129 : Clypéus du mâle. — Fig. 130 : Différentes pièces de l'armature genitale du mâle.

thorax. Clypéus allongé, légèrement échancré à son bord antérieur. Mésonotum ponctué, non strié; pleures très finement rugueuses. Pétiole allongé, très grêle.

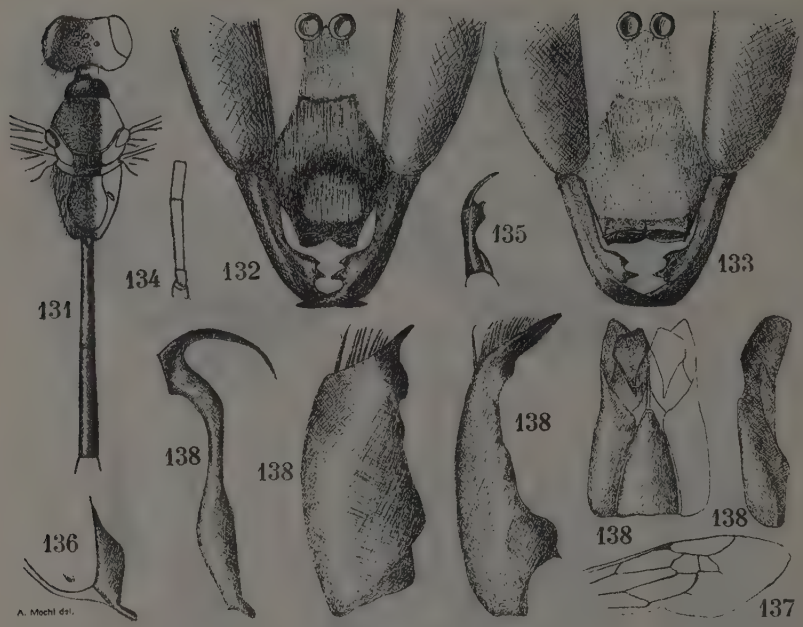
Mâle (décrit par Roth en 1928) : Coloration, pubescence et sculpture comme chez la femelle. Mésonotum un peu plus distinctement striolé. Yeux convergents vers le bas. Clypéus allongé, rétréci en avant, échancré à son bord antérieur. Plaque sternale anale comprimée dans sa partie postérieure. avec une petite carène creuse.

Longueur : ♂, 18 mm.; ♀, 17-19 mm..

Egypte : Mariout (Ikinghi Mariout, Hammam), Mex, en Mars, Juin et Août.

Aire géographique : Décrite du Sud-Tunisien, retrouvée ça et là dans le Nord de l'Afrique.

Espèce désertique.



Ammophila (s. str.) nasuta Lepeletier

Fig. 131 : Aspect général et sculpture de la femelle. — Fig. 132 : Clypéus de la femelle. — Fig. 133 : Clypéus du mâle. — Fig. 134 : Premier article du funicule antennaire du mâle. — Fig. 135 : Mandibule du mâle. — Fig. 136 : Face du mâle, vue de profil. — Fig. 137 : Aile antérieure. — Fig. 138 : Différentes pièces de l'armature génitale du mâle.

23. Ammophila (s. str.) nasuta Lepeletier, 1845.

Femelle : Noire, plus ou moins marquée de rouge-orangé (scape, écaillettes, pattes, arceaux médians de l'abdomen), derniers arceaux abdominaux avec un reflet bleu métallique. Ailes légèrement enfumées, les nervures brunes. Pubescence d'un blanc argenté, très dense sur la tête, sauf un espace lisse sur l'occiput et sur les côtés du thorax, moins dense sur le dessus du thorax et sur l'aire du segment médiaire. Pronotum assez fort, non anguleux sur les côtés, ni bossu au milieu comme chez *quadraticollis* ou *strumosa ;* mesonotum strié transversalement ; scutellum strié en long ; mésopleures et segment médiaire rugueusement striés. Premier article du pétiole aussi long que les deux premiers articles des tarses postérieurs.

Mâle : Semblable à la femelle comme coloration et pubescence ; très reconnaissable à la structure toute particulière du clypéus, celui-ci terminé

à son bord antérieur par une dent plus ou moins triangulaire, coupée carrément en avant, et creuse en dessous, de façon à former une espèce d'auvant.

Longueur : ♂, 18-22 mm. ; ♀, 20-25 mm..

Kohl a figuré la tête des deux sexes (celle du mâle est aussi figurée vue de côté), le premier article du funicule antennaire et la pronotum de la femelle, ainsi que le sternite terminal du mâle.

Egypte : Sinaï (Wadi Um Mitla), ♂ et ♀, en Avril.

Aire géographique : Nord de l'Afrique, depuis la Tunisie jusqu'au Maroc.

24. Ammophila (s. str,) egregia Mocsary, 1881.

Femelle : Noire, plus ou moins bariolée de rouge-jaunâtre ferrugineux. Sont également de cette couleur les deux parties du pétiole et le segment qui suit, ainsi que les pattes ; premier tergite pourvu d'une ligne longitudinale dorsale noire ; partie supérieure des hanches, trochanters et fémurs postérieurs rembrunis ; clypéus, moitié basiliaire des antennes jusqu'aux sixième et septième articles, ainsi que le thorax rouges, ce dernier en partie noir aux sutures et sur l'aire dorsale. Yeux légèrement convergents vers le clypéus. Clypéus éparsément et front densément ponctués, la ponctuation masquée par des poils bruns, peu visible. Pronotum assez lisse, avec des petits points épars. Dorsulum couvert de stries rugueuses transversales, avec des points dans les stries, ainsi que sur les côtés du mésonotum et les métapleures ; scutellum longitudinalement strié-ponctué. Segment médiaire rugueux avec tendance à former des stries, ponctué, l'aire dorsale avec des stries transversales plus nettes. Première partie du pétiole plus longue que la deuxième, un peu moins que le fémur postérieur, à peine plus courte que le tibia, un peu plus longue que les deux premiers articles des tarses. Suture episternale présente. Pattes grêles, peigne de 8 épines. Pulvilli évidents, ongles non dentés.

Mâle : Plus petit et plus grêle ; yeux sensiblement convergents vers le clypéus ; clypéus assez étroit, tronqué en avant en arc très ouvert ; distance entre les yeux et le clypéus égale à la longueur des premier et deuxième articles du funicule. Première partie du pétiole plus longue que la deuxième, un peu plus longue que le tibia postérieur, et égale à la longueur des premier, deuxième et deux-tiers du troisième articles du tarse postérieur. Côtés du mésonotum plus ponctués que rugueusement striés.

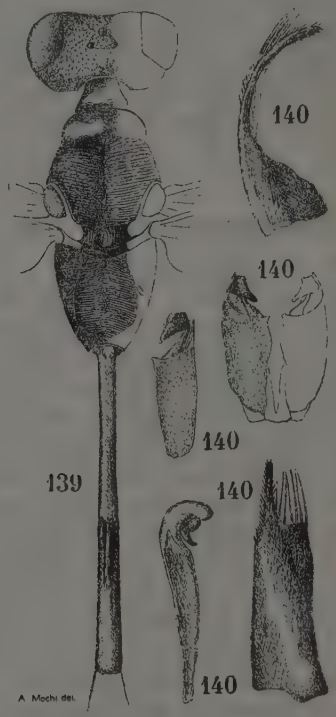
Longueur : ♂, 25-28 mm. ; ♀, 26-33 mm..

La tête et le clypéus de la femelle, ainsi que le premier article du funicule antennaire des deux sexes,ont été figurés par Kohl.

Egypte : Gebel Asfar, Route de Suez (kilom. 94), Wadi Digla et Wadi

Rischrasch, en Mars, Mai, Août et Novembre respectivement; Sinaï (d'après Kohl).

Aire géographique : Syrie.



Ammophila (s. str.) egregia Mocsary

Fig. 139 : Aspect général et sculpture de la femelle. — Fig. 140 : Différentes pièces de l'armature génitale du mâle.

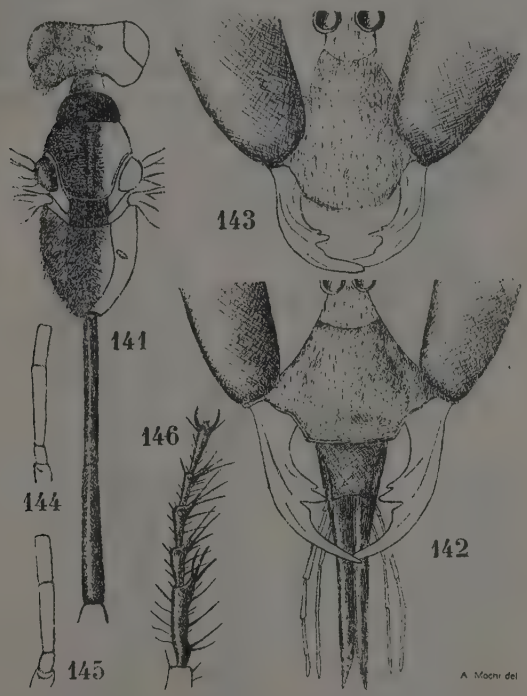
25. Ammophila (s. str.) propinqua Taschenberg, 1869.

? *A. rubripes* Spinola [1838], *syriaca* Moscary [1883].

Femelle : Noire, avec le bord du clypéus, le scape, les écaillettes, une partie du prontum, les pattes, et l'abdomen en partie, rouges; les trois derniers arceaux abdominaux presque ou entièrement noirs, sans reflets métalliques. Ailes très légèrement jaunâtres. Pubescence grisâtre, assez dense, couvrant uniformément le thorax d'une tomentosité blanchâtre sur les derniers arceaux de l'abdomen; cette pubescence souvent plus dense et d'aspect argenté sur les côtés du thorax. Mésonotum strié en travers, avec des points

entre les stries ; aire dorsale du segment médiaire rugueuse, vaguement striée. Pétiole moins long que les deux premiers articles des tarses.

Mâle : Semblable à la femelle, plus petit.



Ammophila (s. str.) propinqua Taschenberg

Fig. 141 : Aspect général et sculpture de la femelle. — Fig. 142 : Clypéus de la femelle. — Fig. 143 : Clypéus du mâle. — Fig. 144 : Premier article du funicule antennaire de la femelle. — Fig. 145 : Premier article du funicule antennaire du mâle. — Fig. 146 : Peigne du tarse antérieur de la femelle.

Longueur : ♂, 18-25 mm. ; ♀ 20-26 mm..

La tête des deux sexes, ainsi que l'armature génitale du mâle, ont été figurés par Kohl.

Egypte : Ezbet El-Nakhié, Marg, Kafr Farouk, Abou Zaabal, Gebel Asfar, Meadi, Wadi Hoff, Abou Rouache, Sakkarah, Fayoum, de Mars à Novembre ; Sinaï (Cheikh Hamid et El-Kreig), en Mai.

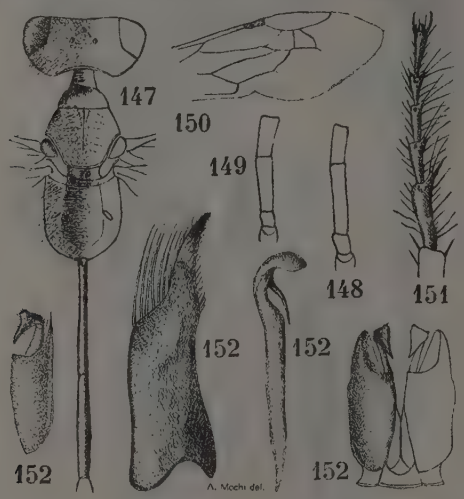
Aire géographique : Syrie, Palestine, Abyssinie, et tout le Nord de l'Afrique.

26. Ammophila (s. str.) erminea Kohl, 1909.

Femelle : Noire ; mandibules, partie antérieure du clypéus, scape, et pattes rouges ; abdomen rouge, sauf les derniers segments qui sont noirs sans reflets métalliques.

Mâle : Plus petit ; coloration semblable à celle de la femelle.

Dans les deux sexes une pubescence argentée recouvre densément tout le thorax au point de laisser difficilement visible sa sculpture. Dans cette



Ammophila (s. str.) erminea Kohl

Fig. 147 : Aspect général et sculpture de la femelle. — Fig. 148 : Premier article du funicule antennaire de la femelle. — Fig. 149 : Premier article du funicule antennaire du mâle. — Fig. 150 : Aile antérieure. — Fig. 151 : Peigne du tarse antérieur de la femelle. — Fig. 152 : Différentes pièces de l'armature génitale du mâle.

espèce le mésonotum n'est pas strié, mais ponctué, ce qui la distingue de *propinqua* Tasch. à laquelle elle ressemble beaucoup.

Longueur : ♂, 18-20 mm. ; ♀, 19-23 mm..

Egypte : Gebel Asfar, Kafr Farouk, Wasta, Fayoum, Route de Suez (kilom. 94), Wadi Hoff, Mex (Alexandrie), de Février à Novembre.

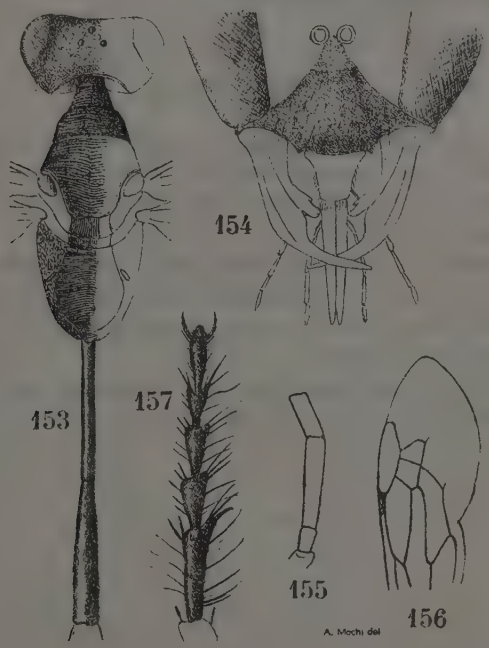
Signalée par Kohl du Sinaï.

Aire géographique : Bords de la mer Rouge, Arabie méridionale, sud Tunisien, Algérie, Maroc et Malte.

27. Ammophila (s. str.) Honorei nov. spec.

Femelle : Noire ; tergites et sternites entièrement bleu métallique foncé ; clypéus, côtés du thorax (pronotum, épimères et propodeum), dessus

des hanches intermédiaires et postérieures, recouverts d'un toment blanc-argenté. Tête noire, très finement ponctuée-chagrinée, éparsement pourvue de poils blanchâtres ; face et épistome garnis d'un duvet blanc argenté serré ; épistome festonné, régulièrement arqué en avant ; mandibules noires, longues, dentées, carénées ; antennes entièrement noires. Thorax noir, avec des poils



Ammophila (s. str.) Honorei nov. spec. (femelle)

Fig. 153 : Aspect général et sculpture. — Fig. 154 : Clypéus. — Fig. 155 : Premier article du funicule antennaire. — Fig. 156 : Aile antérieure. — Fig. 157 : Peigne du tarse antérieur.

épars, blanchâtres ; pronotum longitudinalement ridé, avec une légère dépression en arrière de son milieu ; mésonotum ridé, avec une ligne médiane longue et enfoncée ; métanotum obliquement et rugueusement strié ; mésopleures et métapleures légèrement ridées. Pattes noires, lisses, très peu pruineuses ; ongles orangés. Ailes subhyalines, enfumées, notamment à l'extrémité ; nervures brunâtres.

Mâle : Inconnu.

Longueur : ♀, 18 mm. (holotype [coll. Alfieri]) ; ♀, 19 mm. (allotype [coll. Alfieri]).

Egypte : Route désertique entre Wadi El-Arish et Hassana (Sinaï), 13 Mars 1937 (holotype), et Wadi Mitla (Sinaï), 24 Avril 1938 (allotype).

J'ai dédié cette nouveauté à la mémoire de mon très regretté collègue et ami le Docteur A.-M. Honoré qui a si brillamment contribué à l'étude des Hyménoptères de la faune égyptienne.

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The Genus *Anychus* Mc Gregor in Egypt and the Sudan

[Acarina : Tetranychidae]

(with 17 Text-Figures)

by Dr. M. Taher Sayed

Genus *Anychus* was created by Mc Gregor in 1919. Hirst (1923) described *Anychus latus* from the Sudan, where it was found on lebbek trees at Wadi Halfa. The *Anychus* spec. in Egypt was known to be identical with that which is found in Palestine and which was recorded by Klein (1936) as *Anychus orientalis* Zacher. The author (1942) misled by Hirst's illustration of male *Anychus latus*, considered both species as synonyms and used the name *Anychus latus* for both. Moreover, the material received from the Sudan was not in good condition and mostly males. The distinction between these species is more marked in the female.

It is rather doubtful if *Tetranychus latus* Canestrini and Fanzago is identical with *Anychus latus*. The author agrees with Hirst in the fact that neither Berlese, nor Canestrini had illustrated the finer structural details. The true identity of *Tetranychus latus* can be found by studying Berlese's material or preparations. The author has recently requested the authorities of the R. Stazione di Entomologia Agraria (Florence, Italy), where the late Berlese's collection is found, for their kind cooperation.

Anychus orientalis Zacher compared with Anychus latus C.-F.

♀. — Body, oval round; colour, deep brown; length, 436 μ, including capitulum; breadth, 313 μ. In ♀ *A. latus* length, 400 μ; breadth, 283 μ.

Dorsal view showing transverse, oblique and longitudinal striations differing slightly from those of *A. latus*. Eyes single, oval and antero-lateral. Hairs or setae on dorsum 13 pairs, stiff, pectinated and spatulate. They are

arranged in seven transverse rows : 2, 4, 6, 4, 4, 4, 2. Median hairs comparatively short. In *A. latus* dorsal hairs though pectinated are longer and rather pointed. Collar tracheae simple with enlarged and undivided end-cell.

Ventrally, striations different from those on dorsum.

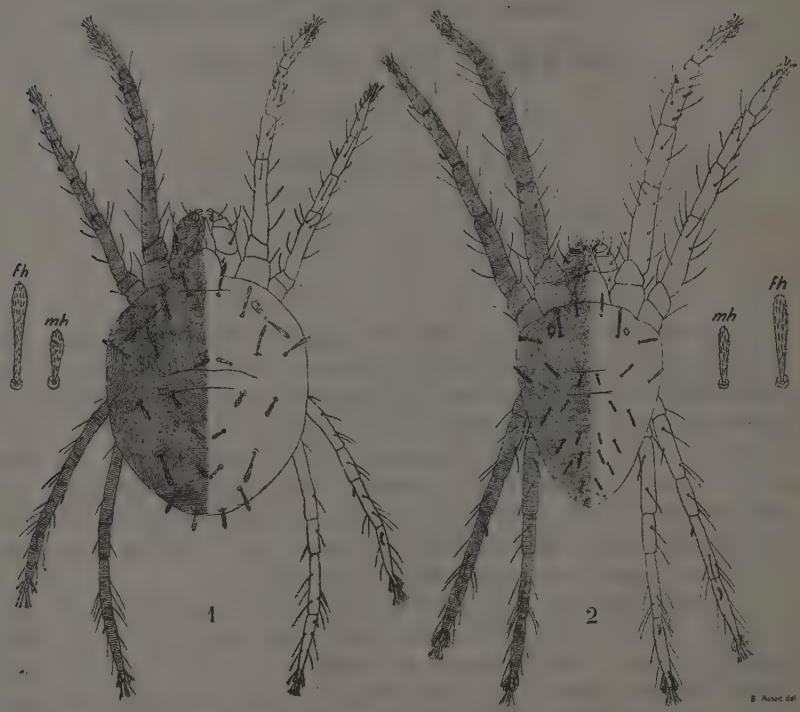

Fig. 1. — *Anychus orientalis* : female, dorsal aspect, × 80. Also dorso frontal (*fh*) and median (*mh*) hair [much enlarged].

Fig. 2. — *Anychus orientalis* : male, dorsal aspect, × 80. Also dorso frontal (*fh*)' and median (*mh*) hair [much enlarged].

Chaetotaxy similar to that of *A. latus* (fig. 4).

Legs rather long ; leg III and IV extending beyond the body and all with distinct, parallel striations.

Tarsi without any claw ; I and II broad and short when compared to III an IV. Tenent hairs in four groups, each having three fine hairs, situated on a peduncle (figs. 11-13). Dorsally, near the apex of tarsi there is a pair of dorsal, curved and flattened setae. The end is enlarged and looks bilobed.

Hairs on legs seem to be all pectinated except the « sensory » hairs. These are comparatively short and curved. In tarsi I, II and III the number is 6, 5 and 3 respectively. Tarsus IV is like tarsus III. These sensory hairs are also found on the penultimate segment of leg I, II and III. They are 4, 2 and 1 respectively.

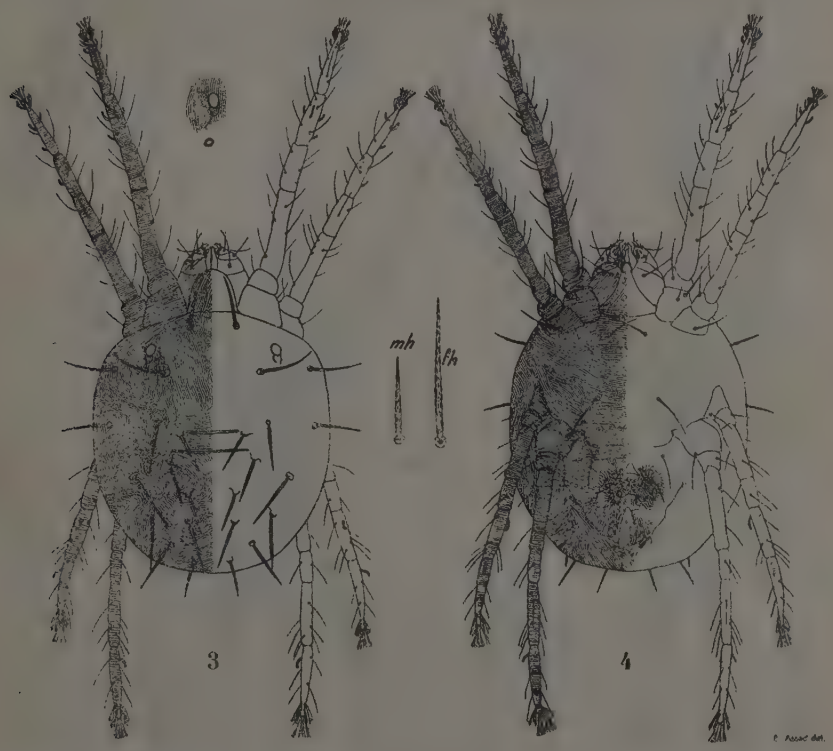

Fig. 3. — *Anychus latus* : female, dorsal aspect, × 80. Also dorso frontal (*fh*) and median (*mh*) hair, and eye (o) [much enlarged].

Fig. 4. — *Anychus latus* : female, ventral aspect, × 80.

Mouth-parts : Mandibles styliform as in other Tetranychids. Palp four-segmented, the basal or proximal segment with a small hair in both sexes. This is missing in *A. latus*. The terminal, sensory finger is much developed in the female palp. It is as nearly as long as the seta close to it. The dorsal sensory finger is much smaller and nearly cylindrical. Moreover, there are two, long and rather narrow setae and all situated on the palpal thumb which differs in both sexes (figs. 7-10). Hairs on the palp are pectinate

except one near the base of the claw. The palp of *Anychus latus* shows slight modifications.

♂. — Body triangular in shape and light brown in colour. Length, 383 μ, including capitulum; breadth, 206 μ. In *A. latus* length, 345 μ; breadth, 204 μ.

Dorsal striation different from that of female.

Fig. 5. — *Anychus latus* : male, dorsal aspect, × 82. Also dorso frontal (*fh*) and median (*mh*) hair [much enlarged].

Fig. 6. — *Anychus latus* : male, ventral aspect, × 82.

Hairs on dorsum 13 pairs, pectinate, spatulate and rather short. Those of *A. latus* are longer and somewhat pointed especially the lateral ones. Moreover, there are four, small, entire hairs at the posterior end of the body

in both species. As in the female, there are two, short transverse lines on dorsum. Legs similar to those of female. Ventral hairs ordinary, 8 pairs, five of which are very short, at the posterior end of the body.

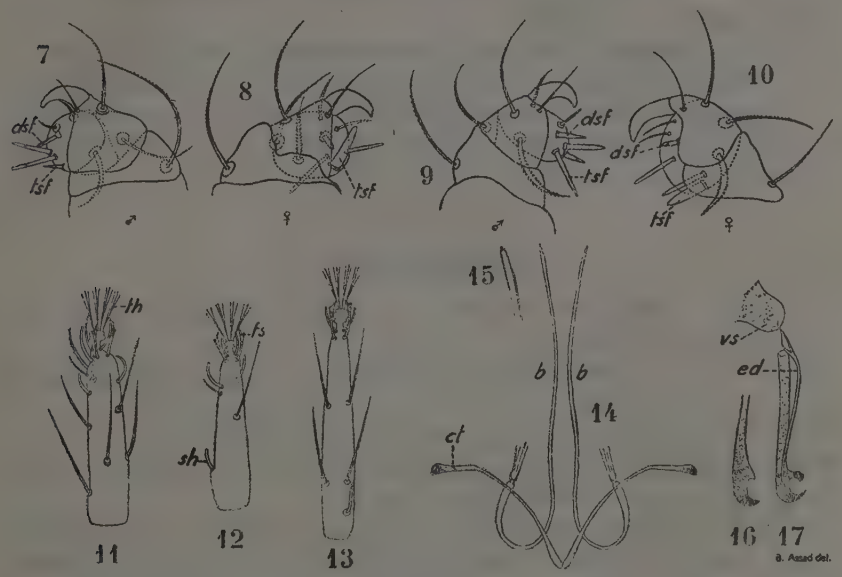

Fig. 7. — *Anychus orientalis* : terminal part of male palp (*dsf*, dorsal, and *tsf*, terminal sensory fingers) [much enlarged].

Fig. 8. — *Anychus orientalis* : terminal part of female palp (*tsf*, terminal sensory finger) [much enlarged].

Fig. 9. — *Anychus latus* : terminal part of male palp (*dsf*, dorsal, and *tsf*, terminal sensory fingers) [much enlarged].

Fig. 10. — *Anychus latus* : terminal part of female palp (*dsf*, dorsal, and *tsf*, terminal sensory fingers) [much enlarged].

Fig. 11. — *Anychus orientalis* : male and female, tarsus I (*th*, four groups of tenent hairs) [much enlarged].

Fig. 12. — *Anychus orientalis* : male and female, tarsus II (*fs*, flattened seta; *sh*, sensory hair) [much enlarged].

Fig. 13. — *Anychus orientalis* : male and female, tarsus III [much enlarged].

Fig. 14. — *Anychus orientalis* : collar tracheae (*ct*) and mandibles (*b*) [much enlarged].

Fig. 15. — *Anychus orientalis* : tip of the mandible [much enlarged].

Fig. 16. — *Anychus latus* : penis [much enlarged].

Fig. 17. — *Anychus orientalis* : penis, ejaculatory duct (*ed*), and vesicula seminalis (*vs*) [much enlarged]

Palp differs from that of female. The terminal sensory finger is represented by a small spine and the dorsal sensory finger is nearly cylindrical.

Penis strongly curved. The ejaculatory duct and vesicula seminalis are distinct. In *A. latus*, penis is not much curved and moreover, the ejaculatory duct and the vesicula seminalis are not seen.

Distribution : Upper and Lower Egypt. *A. latus* has been found in different parts of the Sudan.

Host-Plants : Citrus trees (leaves and fruits), *Ricinus communis* L. and some ornamental trees such as *Melia azadirachta* L. and *Albizzia lebbek* L.

The genus is represented in America by *A. banksi* Mc Gregor in Florida and *A. rusti* Mc Gregor in Peru. Tucker (1926) describes *Anychus africanus* from South Africa, on oranges.

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Three new *Eriophyid* Mites from Egypt

[Acarina Eriophyidae]

(with 24 Figures) Exd

by Dr M. Taher Sayed

Debski (1918) records an *Eriophyes* sp. on *Acacia arabica* var. *nilotica* Forsk. The mite has not been described yet.

Figari (1864-1865) refers to « scabia » which he describes as small protuberances under the epidermis of the leaves of *Conyza aegyptiaca* (=*Pluchea dioscoridis* L.) and in which lives a very minute insect imbedded in cottony wool. Debski (1919) refers to Figari's note and mentions that the « protuberances are only due to an *Eriophyes*, which is probably new ». In the same year, but in another paper, Debski records *Eriophyes Alfierii* nov. spec. on *Pluchea dioscoridis* L. The name was given as a tribute to our colleague A. Alfieri, the Egyptian entomologist who collected the mite from the garden of Gezira National Sporting Club, Cairo.

Unfortunately, neither Debski, nor any other specialist attempted to describe these two mites.

In 1936 the present author, while looking for *Dolichotetranychus* (= *Pseudoleptus*) *floridanus* Banks on *Cynodon dactylon*, found an unknown Eriophyid on that plant. In many cases the two mites were living together. Infested plants are usually stunted, leaves much crowded and overlapping.

Drawings of the three above mentioned Eriophyid mites were sent to Dr. H. H. Kiefer the well-known American acarologist of the Department of Agriculture, California, who agreed that these mites are new and moreover, lie under the genus *Aceria* recently created by him.

The present author wishes to acknowledge with grateful thanks the kind help and advice given by Dr. Keifer.

Aceria acaciae nov. spec.

Female : 145 μ long, including capitulum ; 41 μ broad ; colour whitish ; spindle-shaped ; rostrum 16.4 μ long with a pair of small setae on its distal

end. Dorsal shield arched, with sculpture of unusual type (fig. 3). Dorsal setae 11.3 μ, projecting backward. Leg I 42 μ long, including feather claw which is 5-4 μ, 6 rayed, distal ray being the smallest, without tubercles and doubled; leg II 34 μ, claw not knobbed, longer than feather claw and tapering. First thoracic setae 6 μ, second 22 μ, third 19.1 μ; lateral setae 16 μ; first ventral setae 28 μ, second 8.9 μ, third 24 μ; caudal setae 58 μ and genital setae 7.8 μ.

The mite is found inside deep red galls in the leaves of *Acacia arabica* var. *nilotica*. On leaving the galls, they may seek shelter in the opened galls of *Phytoptipalpus paradoxus* Trägårdh found on the bark of acacia tree. No acarologist has attempted to describe it since Debski referred to it as *Eriophyes* spec.

Distribution : Lower and Upper Egypt.

Aceria Alfierii nov. spec.

Female : 180 μ long, including capitulum; 41 μ broad; cylindrical, creamy in colour; rostrum with a pair of setae anteriorly. Dorsal shield triangular, rather plain, without much sculpture (fig. 11). Dorsal setae 15.6 μ, projecting backward. Leg I 37.4 μ, including feather claw, leg II 36.9 μ. Feather claw (fig. 14) 4-rayed, bifurcating at its distal end, 5.4 μ; claw not knobbed and longer than feather claw. First thoracic setae 6.5 μ, second 16.1 μ, third 26.9 μ; lateral setae 13.1 μ. First ventral setae 28.7 μ, second 6 μ, third 15 μ; caudal setae 41.3 μ. Genetalia 16.4 μ long, genital setae 10.1 μ; accessory setae 3.6 μ. Tergum 2 μ, sternum 2.7 μ. Skin sculpture similar to arrangement of bricks of unequal size.

Distribution : Lower and Upper Egypt.

Aceria cynodoniensis nov. spec.

Female : 210.9 μ, including capitulum; 43.8 μ broad; colour whitish; cylindrical; rostrum 19.1 μ long with two pairs of setae; dorsal shield somewhat conical with five longitudinal lines and fine sculpture (fig. 19). Dorsal setae 30 μ, projecting forward. Leg I 41 μ, including feather claws (5-4 μ), leg II 40 μ; claw not knobbed. Feather claw 6-rayed, ending distally with a single, median ray. Thoracic setae I 6.5 μ, II 15 μ, III 21 μ; lateral setae 30.5 μ; first ventral setae 36.5 μ, second 6.5 μ, third 2.4 μ; caudal setae 60 μ; genital setae 10 μ, genetalia 24.6 μ long and 12.3 μ broad. Ventral skin structure as illustrated (fig. 23), the last four posterior, sternal divisions with elongated tubercles.

Distribution : The mite is found in Lower Egypt and round Cairo. Upper Egypt has not been surveyed.

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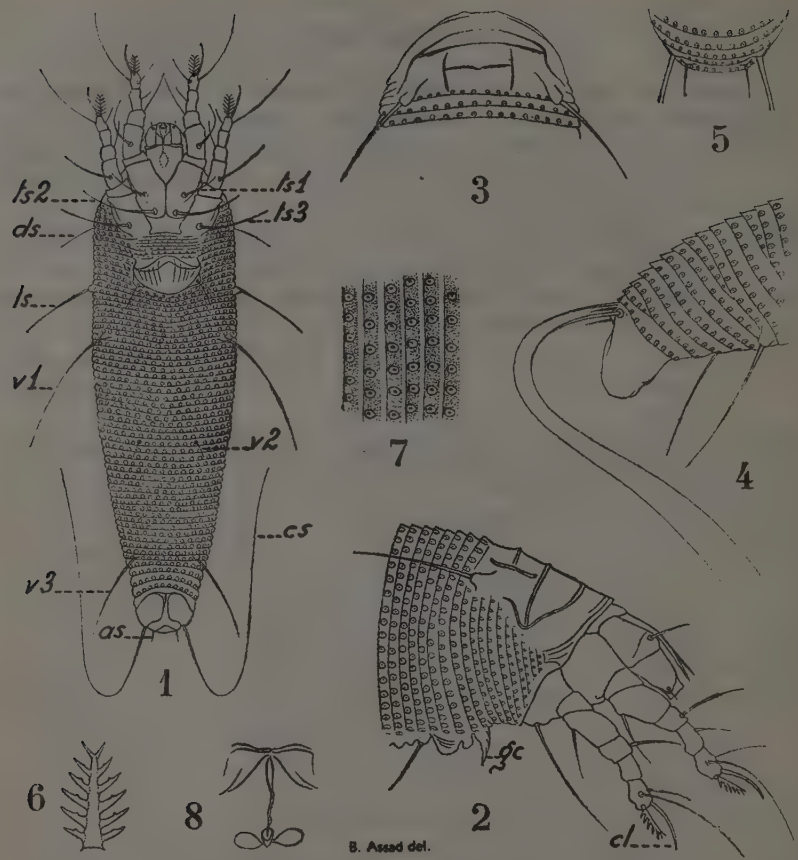
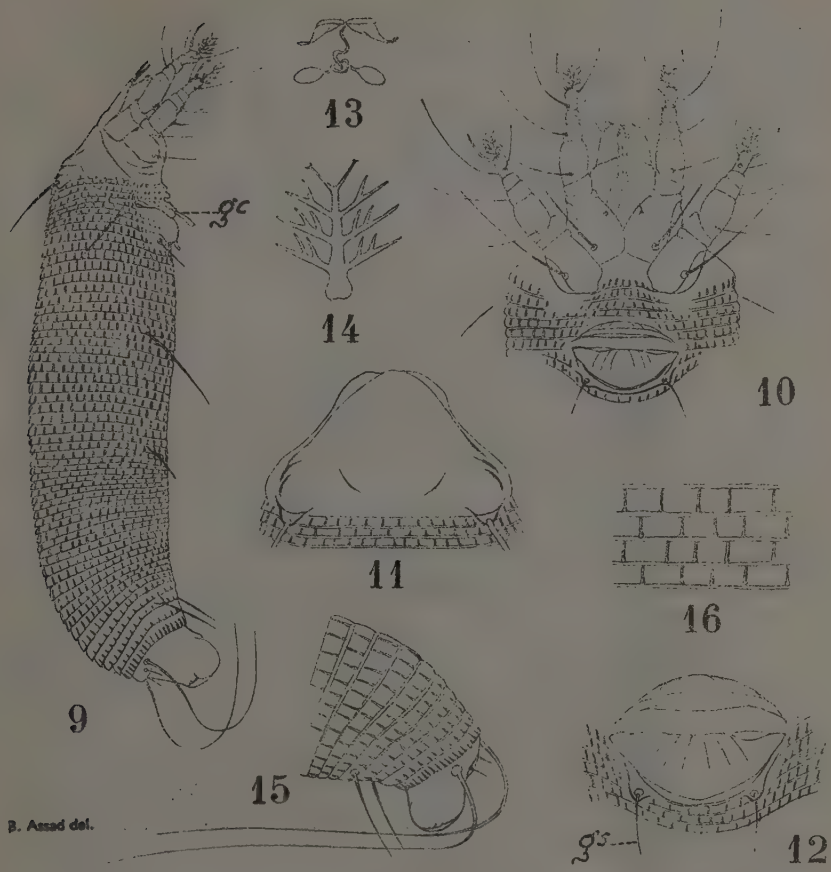


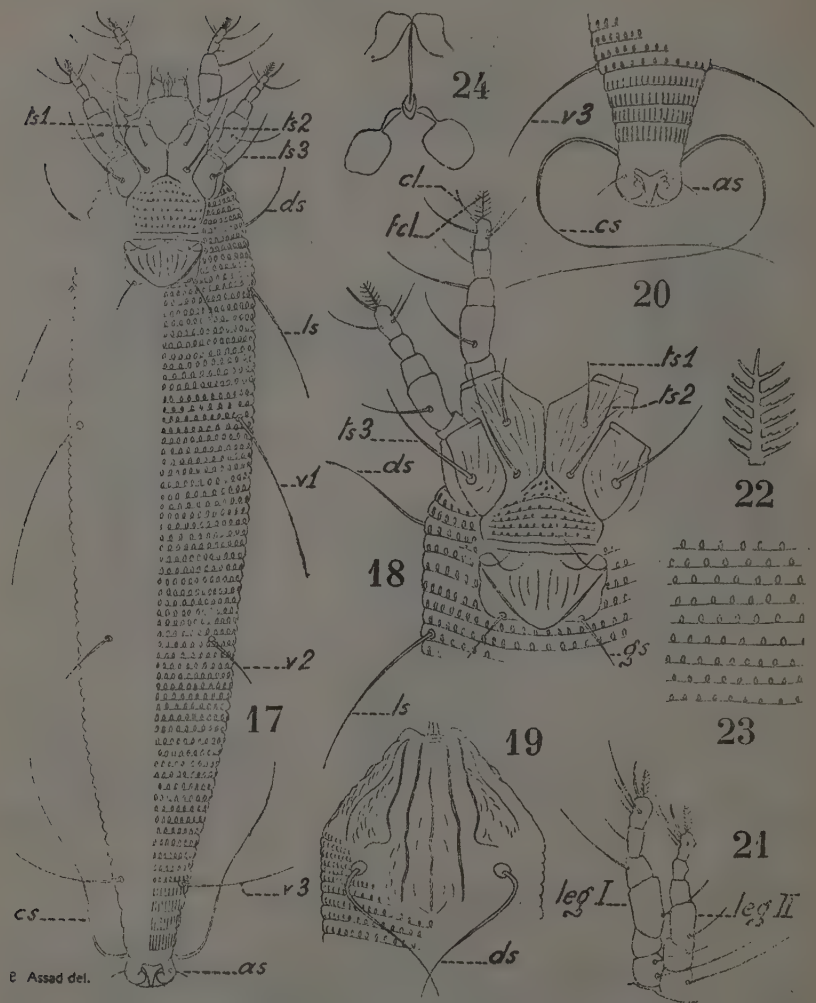
Aceria acaciae nov. spec., female.

Fig. 1 : Ventral aspect (*as*, accessory setae; *cs*, caudal setae; *ds*, dorsal setae; *ls*, lateral setae; *ts1*, thoracic setae I; *ts2*, thoracic setae II; *ts3*, thoracic setae III; *v1*, ventral setae I; *v2*, ventrae setae II; *v3*, ventral setae III), × 600. — Fig. 2 : Anterior part of the body, lateral (*cl*, claw; *gc*, genital cover palp). — Fig. 3 : Dorsal shield. — Fig. 4 : Posterior part of the body, lateral. — Fig 5 : Posterior end of the body. — Fig. 6 : Feather claw. — Fig. 7 : Skin sculpture with tubercles. — Fig. 8 : Internal part of genitalia. — Figures 2-8 are greatly enlarged.



Aceria Alfierii nov. spec., female.

Fig. 9 : Lateral aspect (*gc*, genital cover flap), × 600. — Fig. 10 : Anterior part, ventral. — Fig. 11 : Dorsal shield. — Fig. 12 : Genitalia showing genital cover flap and genital setae (*gs*). — Fig. 13 : Internal genitalia. — Fig. 14 : Feather claw. — Fig. 15 : Posterior end, lateral. — Fig. 16 : Skin sculpture. — Figures 10-16 are greatly enlarged.



Aceria cynodoniensis nov. spec., female.

Fig. 17 : Ventral aspect (*as*, accessory setae; *cs*, caudal setae; *ds*, dorsal setae; *ls*, lateral setae; *ts1*, thoracic setae I; *ts2*, thoracic setae II; *ts3*, thoracic setae III; *v1*, ventral setae I; *v2*, ventral setae II; *v3*, ventral setae III), × 600. — Fig. 18 : Anterior part, ventral (*cl*, claw; *fcl*, feather claw; *ds*, dorsal setae; *gs*, genital setae; *ls*, lateral setae; *ts1*, first thoracic setae; *ts2*, second thoraric setae; *ts3*, third thoracic setae). — Fig. 19 : Dorsal shield (*ds*, dorsal setae). — Fig. 20 : Posterior end (*as*, accessory setae; *cs*, caudal setae; *v3*, third ventral setae). — Fig. 21 : Fore and hind legs. — Fig. 22 : Feather claw. — Fig. 23 : Skin sculpture. — Fig. 24 : Internal genitalia. — Figures 18-24 are greatly enlarged.

Preliminary Tests on the Use of Crude Benzene Hexachloride (or 666) against Locusts and Grasshoppers

(with 5 Tables) E.H.N.

by Mohamed Hussein
Senior Entomologist, Ministry of Agriculture, Egypt.

Arsenical compounds have been extensively used for the destruction of locusts and grasshoppers.

Although they proved to be most efficient, economic and easy in preparation, their toxicity to man and animal and their severe scorching effect on plant necessitated great care in application, or even in some cases, the abandoning of materials tested.

Extensive experiments were carried out with many organic and inorganic compounds of manganese, fluorine, barium salts, pyrethrum, derris, etc., in the search for a substitute for arsenicals.

The results were not encouraging because the materials tested either approached arsenicals in toxicity, or gave very inferior results, or were highly expensive.

During the last war two new insecticides, namely 666 and DDT, were made known.

At first their use was confined to military purposes. Later both were tested and then applied to the control of insects.

In 1946 the first compound replaced sodium arsenite or bran bait for combatting the desert locust in the Arabian peninsula.

At about the same time experiments began in the Locust Research Organisation of the Egyptian Ministry of Agriculture with 666 and much more recently with DDT to solve the following problems :

(1) The standard dose of either insecticide to be used against some species of locusts and grasshoppers referred to later.

(2) Their mode of action on hoppers and adults.

(3) The effect on men, animals and plants.

(4) Stability of material.

The following is a résumé of preliminary results obtained up till now with 666. Experiments carried out so far with DDT do not permit final deductions. It is hoped to give a detailed account of the progress of the work in future.

Material and Technique

(1) The following species of locusts and grasshoppers in their different stages of development were subjected to experiment :

(a) The desert locust, *Schistocerca gregaria* Forskal.

(b) The migratory locust, *Locusta migratoria migratoriodes* Rehn and Fairm.

(c) The Egyptian locust, *Anacridium aegyptium* L.

(d) The grasshopper, *Euprepocnemis plorans* Charp.

Results of experimenting with the first species will be discussed in this paper.

(2) Treated samples were collected from general breeding cages and kept for 24 hours in small cages (dimensions $20 \times 20 \times 40$ cms.).

(3) During this period they were given either berseem (*Trifolium alexandrinum*) or maize leaves (*Zea mays*).

(4) In each series of experiments no less than 100 insects from each stage were treated.

(5) For every experiment there were control cages to show the number of dead hoppers and fliers. The pyysiological condition of insects as well as air temperature and humidity seem to be largely responsible for variations in some results obtained.

(6) The 666 used contained 80 % gypsum. The remaining 20 represented the four isomers of benzene hexachloride of which 13 % was the gamma, or gammexane, the active principle in the crude material.

Baiting Experiments

(1) Bait was prepared by the dry method. Wheat bran of specific fineness was thoroughly mixed with the compound and then moistened with water. It was scattered as evenly as possible over the floors of the cages in the morning when the treated insects showed signs of normal activity. This usually happened with air temperature ranging from 18°-23° C.

(2) Sodium arsenite in the standard experiments contained 71.84 % arsenious trioxide (As_2O_3). It was dissolved in water and then mixed with wheat bran.

(3) The readings were taken every half-hour during daytime.

(4) Table I illustrates results of baiting experiments.

TABLE I

Baiting with a preparation containing 20 % Crude Benzene Hexachloride (666) with 13 % Gammexane against the different Stages of *Schistocerca gregaria* Forskal

PERCENTAGE OF 666	FIRST STAGE					SECOND STAGE					THIRD STAGE					FOURTH STAGE					FIFTH STAGE					IMMATURE ADULTS				
	FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL	
	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes
0.1	2	30	30	72	—	7	—	20	72	—	12	—	40	80	—	24	—	40	96	—	24	—	30	96	—	24	—	20	120	—
0.2	2	—	34	24	—	2	45	22	48	—	4	—	20	53	—	4	—	20	72	—	9	—	25	72	—	24	—	30	96	—
0.4	1	40	30	24	—	2	15	20	24	—	3	—	25	36	—	4	—	30	48	—	6	—	25	52	—	7	—	26	72	—
0.6	1	30	33	12		2	—	26	12	—	3	—	33	20	—	3	45	35	24	—	4	—	30	24	—	5	15	35	36	—
0.8	1	30	40	8	—	1	30	30	12	—	2	—	30	12	—	3	—	35	16	—	3	15	32	24	—	4	—	30	24	—
1.0	1	15	32	6	—	1	30	30	8	—	1	45	35	11	—	2	15	40	10	—	3	—	45	12	—	3	45	50	12	—

Discussion

(1) Nervousness followed by paralysis in the locomotive organs of the insects took place 10-50 minutes after the application of the bait according to the age of treated locusts.

(2) Actual death occurred after a varying interval as shown in Table I.

(3) 0.4 % of crude benzene hexachloride (666) used can be regarded as standard dose for first and second stage hoppers, and 0.6 % for more advanced ages including adults.

(4) An increase in the percentage of this insecticide in baits, above one per cent, gave a quicker rate of mortality. It meant, however, an unjustifiably high increase in the expenses of locust and grasshopper campaigns.

(5) 100 % kill obtained by the application of 2 % sodium arsenite bait, containing 71.84 % As_2O_3 approaches 0.2 % of 666 in first to third stage hoppers, and 0.4 % for fourth and fifth ages, while for immature fliers it corresponds to the range 0.4%-0.6%.

Therefore 666 used in the above experiments was 10, 5 and 3 times more toxic than the standard 2 % sodium arsenite.

Spraying Experiments

(1) Benzene hexachloride is insoluble in water, every precaution should therefore be taken to avoid precipitation.

The gypsum sometimes clots at the openings of hand sprayers.

(2) Two ready made liquid preparations were tested. The first contained 7 % of the gamma isomer dissolved in decahydronaphthaline. The second, a dilution of the former in odourless petroleum distillate, contained only 0.35 % of this isomer. Both killed the treated locusts in the various stages either instantaneously or after 10-20 minutes. It should be noted, however, that the solvents in both preparations are known :

(a) To be effective against Acrididae.

(b) To have a severe scorching effect on plants.

(c) To be expensive and thus do not permit the application on a large scale.

(3) Treated locusts, as well as their green food, were sprayed but the insects hardly attempted to feed.

(4) Air temperature and humidity inside the cages were recorded.

(5) Readings were taken every 15 minutes during daytime.

(6) Table II gives particulars of spraying experiments.

Discussion

(1) In the first to third stage hoppers 0.2 % of 666, i.e. 1 % of the compound, gave high mortality percentage in a comparatively short time.

TABLE II

Spraying Experiments with a suspension containing 20 % Benzene Hexachloride in water against the different Stages of *Schistocerca gregaria* Forskal.

PERCENTAGE OF 666	FIRST STAGE					SECOND STAGE					THIRD STAGE					FOURTH STAGE					FIFTH STAGE					IMMATURE ADULTS				
	FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL	
	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes
0.2	1	—	95	1	45	1	15	32	2	45	1	30	20	6	15	2	45	40	60	—	3	—	20	90	—	2	15	20	100	—
0.4	1	—	80	1	20	—	55	40	1	50	1	45	40	3	30	1	15	20	40	—	2	15	30	50	—	2	15	20	70	—
0.6	—	15	90	1	20	1	—	20	1	30	1	30	50	3	30	1	15	40	38	—	2	—	40	36	—	2	—	20	40	—
0.8	—	35	40	1	—	—	45	50	1	30	1	15	50	3	15	1	15	60	21	—	1	30	20	24		2	—	40	24	—
1.0	1	—	80	1	—	—	45	60	1	—	1	—	60	2	—	2	—	30	13	30	3	15	30	16	—	1	30	25	18	—
2.0	—	20	90	—	25	—	15	80	—	45	—	30	60	1	15	1	15	50	3	—	1	30	60	6	—	2	—	60	10	—

(2) Fourth and fifth stages, and also immature adults, appear to be resistant to these low dosages and were thus raised to 0.8 % and 1 % to give satisfactory results.

(3) When 2 % of 666 was applied a remarkable fall in the duration of time until death was noticed.

Dusting Experiments

(1) Four carriers were used :

(a) Rock phosphate.

(b) Quena clay, a pale reddish material obtained from desert valleys near Quena, a province in Upper Egypt.

(c) Talc.

(d) Dry Nile alluvium.

The specific gravity of talc was found to be lower than any of the other three materials and unless taken on a volume basis more talc was required to form a proportional mixture by weight corresponding to the other three carriers.

Also talc was dear in price and imported from abroad.

The effect of rock phosphate and Quena clay on locusts is being studied.

The relatively high density of alluvium, due to its silica content caused it to emerge from the duster in a glutinous state instead of forming a foam.

(2) Both the treated locusts and the food were dusted. Here again, as in the spraying tests, the insects did not attempt to feed.

(3) Readings were taken at 15 minutes' interval.

(4) Dosages below 1 % of 666 gave low mortality rate.

(5) Table III shows results of trials.

Discussion

(1) 1 % of 666 gave 100 % kill in first to fourth hopper stages after the lapse of 12-24 hours. When the dosage was doubled there was a noticeable fall in the duration of time.

(2) 4 % of 666 can be taken as an adequate dosage for more advanced hoppers as well as adults.

(3) When benzene hexachloride was used as a dust without any carrier, 100 % mortality was attained in less than one hour for first to third stage hoppers and in 2-6 hours for other stages.

(4) It deserves mention that immature adults were less resistant to 666 when applied as a dust than fifth stage hoppers.

No exact explanation of this deduction can now be given. It might be due to the action of the poison on the nervous system of the fliers through the nerve endings. This point needs further study.

TABLE III

Dusting Experiments with a preparation containing 20 % Crude Benzene Hexachloride (666) against the different Stages of *Schistocerca gregaria* Forskal

PERCENTAGE OF 666	FIRST STAGE					SECOND STAGE					THIRD STAGE					FOURTH STAGE					FIFTH STAGE					IMMATURE ADULTS				
	FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL		FIRST KILL			100 % KILL	
	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes	Hours	Minutes	Percentage	Hours	Minutes
1	2	30	55	12	30	1	30	20	14	—	4	—	52	18	—	4	—	50	24	—	24	—	50	40	—	9	—	20	26	—
2	—	30	30	1	15	—	20	40	2	—	3	—	40	12	—	3	—	30	20	—	20	—	60	37	—	12	—	50	24	—
3	—	20	52	1	—	—	20	30	2	—	1	15	20	10	—	3	—	50	16	—	23	—	40	30	—	4	—	30	24	—
4	—	20	60	1	15	—	20	50	1	30	1	30	40	4	—	1	30	30	12	—	2	30	50	18	—	2	30	60	22	—
5	—	15	50	1	—	—	10	40	1	30	1	15	30	2	—	1	—	20	6	—	2	—	30	10	—	2	—	50	18	—
6	—	20	60	—	45	—	15	50	1	15	—	30	40	1	—	—	45	40	6	—	2	—	30	10	—	2	—	50	8	—
20	—	20	90	—	30	—	15	90	—	40	—	20	70	—	45	—	30	50	2	—	—	15	20	2	—	1	20	40	6	—

The Effect of Benzene Hexachloride on treated Locusts

(1) In some of the baiting experiments first and second stage hoppers died without eating from the mixture.

(2) More advanced hoppers as well as immature adults took this poisoned compound and death occurred after a varying duration of time according to their stage development.

(3) It was noticed, however, that mortality took place in some cases immediately after feeding. Whether this was due to the effect of the poison on the digestive system, the nervous system or both is open to question.

(4) In spraying and dusting tests, treated locusts in all stages hardly attempted to eat from the green grass. Death occurred after a varying period according to the age of the insects. This duration of time was on the whole shorter than with baits.

(5) Immature adults showed less resistance to the poison when applied as dust than fifth stage hoppers.

(6) In a series of experiments with first to fourth stage *Schistocerca* hoppers, Agricode 7 (a dust, as already mentioned with 20 % 666) was thinly distributed over the floor of small breeding cages (20 × 20 × 40 cms). The treated hoppers were liberated in this environment on a wire gauze floor situated 10 cms. above the base of the cage, in order to examine the effects of the compound as a fumigant.

Table IV shows the mortality of treated hoppers at various periods of exposure.

TABLE IV

HOPPER STAGE	FIRST KILL			HOURS FOR 100 % KILL
	Hours	Minutes	Percentage	
First	2	—	40	14
Second	2	40	20	16
Third	5	30	20	26
Fourth	20	—	20	60

(7) Cages previously used in dusting experiments were thoroughly washed with water and then left to dry.

Fifty first stage hoppers of the desert locust, the migratory locust and the clover grasshopper were liberated in these cages. All died within 24 hours.

(8) Whether baited, dusted or sprayed with 666, treated locusts showed practically in every case the same symptoms :

They remained motionless for a short time, then became nervous and excitement followed. During this stage of abnormal activity, they jumped or flew or dashed from one side of the cage to the other in an disorderly manner. These continuous and vigorous movements gradually died out. The insects reached a stage of stupor. They could hardly move except after exerting great effort. They were paralysed, and lying on one side moved their hind locomotive organs in a vibratory manner.

Gradually these movements ceased and death followed. As a result of their previous abnormal activity their hind legs often separated from the body near the coxa and even if they remained attached the slightest movement was sufficient to cause them to fall from the body.

(9) The above observations show that benzene hexachloride is both a stomach as well as a contact insecticide.

(10) The question of the inhalation of 666 and its effect on treated insects should also be taken into consideration.

(11) The compound effects the nervous system of locusts due most probably to its action on the nerve endings.

(12) There still remains much work in this line of research before the problem is thoroughly solved.

The Effect of Benzene Hexachloride on Men, Animals and Plants

Human Beings

(1) Benzene hexachloride has an unpleasant smell and when applied in an enclosed environment this odour is noticeable for a long time.

(2) Heavy breathing and coughing are symptoms of its effect on the respiratory system. Inflammation of the skin and specially round the eyes and limbs has been often noticed.

(3) When mixed or applied in the open many of these troubles as manifested externally can be avoided.

(4) It remains to be seen if 666 has any bad effect on the nervous constitution of those who handle and use the material for a comparatively long period.

Animals

(1) A special committee has been set up by the Egyptian Government

to invesigate the toxicity of 666 and DDT. Work is still in progress and it will take some time before a detailed account can be published.

(2) One line of research undertaken was to find out the effect of 666, when applied as bait, dust or spray, on goats and other similar animals.

(3) Experiments began with goats and the main points arrived at up till now after preliminary investigations show that :

(a) Feeding goats with half-a-kilogramme of barley mixed with one kilogramme of wheat bran containing 5 % 666 resulted in paralysis of limbs after 3-4 weeks, followed by coma and death after 4-5 weeks.

(b) Feeding goats daily on 20 pounds of green maize dusted with 50 grammes 666, of which nearly 16 pounds were actually consumer by the beast, resulted in paralysis of limbs followed by death after 56 days. On making post-mortem examination it was found that death in this case was due to pneumonia and abscesses on the lungs.

(c) Another goat fed for 20 days on the same green fodder dusted with the same percentage of 666 is still alive.

(d) The compound had no deterrant effect and the goats took their food whether wheat bran with barley or green maize, readily.

(e) These preliminary tests show clearly that benzene hexachloride is far less toxic to some domestic animals than sodium arsenite.

Plants

(1) Plants in pots : on 15.11.45 lupins, beans, clover, fenugreek, lentils, *Lathyrus* sp., common flax, wheat and barley were sown in small pots.

(2) A month later they were divided into groups :

(a) Sprayed with a 5 % suspension of 666 in water.

(b) Dusted with 20 % of the compound.

(c) Treated with gammexane preparations referred to in the following.

(d) Left as control.

(3) All the pots were examined daily and after a lapse of 30 days no effect on foliage or growth was observed in groups (a) and (b).

(4) Group (c) was subjected to treatment by four gammexane preparations. Two of which, L.C.037 and L.094 were applied as sprays while Agricode 7 and D.034 were tried in the form of dusts.

(5) It has been already mentioned that gammexane concentrate L.C.037 contains 7 % gamma isomer dissolved in decahydronaphtaline. Within 20-30 minutes after application the foliage began to wither, became dark in colour and wilted. On the next day it changed into a yellow colour, and after 48-72 hours lost all its water content and became dry.

(6) Liquid gammexane L.049, a dilution of the former compound in odourless petroleum distillate, had the same effect on treaed plants. It took,

however, from 5-7 days before the process was completed. This bad effect on plants is due most probably to the solvents in both preparations.

(7) Both Agricode 7, which contains 20 % of 666 with 80 % gypsum and gammexane dust D.034 with 4 % of the compound and China clay had no ill effect on treated plants.

(8) The above experiments were made on 18th May 1946 and treated plants remained under observation for one month.

Trees

(1) At 12.30 p.m. on 17.12.45 *Citrus nobilis, C. limetta, C. sinensis, Rosa centifolia, Sesbania aegyptiaca, Bougainvillea spectabilis, Eucalyptus rostrata, Casuarina equisitifolia* and *Clerodendron inerme* trees were either sprayed with a 5 % water suspension of 666 or dusted with 20 % of the compound.

(2) The plants remained under examination for two months. No effect was noticed as a result of both processes and the trees remained in the same condition as in the control.

Crops in the Field

(1) On 17.12.45 about 200 square metres of green clover 45 days old were sprayed with a 5 % water suspension of 666 in water. A similar area was dusted with 20 % of the compound.

(2) A month later both treated plots were as green and as healthy as the control.

(3) During July and August 1946 plots in some rice fields in Lower Egypt were either sprayed or dusted with the above mentioned concentrations of 666 without any bad effects to the plants.

Stability of Benzene Hexachloride

(1) The main object of these experiments was to ascertain if 666 used in locust baits loses its efficiency through exposure to the atmosphere.

(2) For this purpose wheat bran was mixed with benzene hexachloride, of specifications already mentioned, at the rates of 2 % and 3 %.

(3) The bait was then dried in the sun for three days and kept for another thirty days in calico bags. On the day of application two baits of the same strength (2 % and 3 %) were prepared.

(4) The old bait was remoistened with the same quantity of water as in the fresh bait, and then used.

(5) Experiments were carried out on fifth stage *Schistocerca* hoppers. Air temperature and humidity were recorded. There were also control cages.

TABLE V

Experiments with old and newly prepared baits with 20 % Crude Benzene Hexachloride (666) against the Fifth Stage of *Schistocerca* hoppers

BAIT USED	PERCENTAGE OF 666	FIRST KILL			HOURS FOR 100 % KILL
		Hours	Minutes	Percentage	
New bait	2	1	30	40	14
Old bait.....	2	4	30	20	120
New bait	3	—	40	60	8
Old bait.....	3	3	—	30	96

(6) Table V gives results.

These preliminary tests show that 666 in bran bait when exposed to atmosphere for some time does not remain stable and loses its efficiency.

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DE LA

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